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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK, GREAT BRITAIN, No. 410426 REG. U. S. PAT. OFF.

Oil Volcano in Ocean
PAGE 682

"Success"- C.M.Schwab
PAGE 701

Be an Auto and Electrical Expert

McSweeny Trained Men in Demand at $40 to $150 a Week

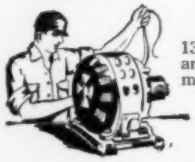
Here's one instance of the success McSweeny Training has brought thousands of men:

George W. Smith, West Alexandria, O., has earned over $800 a month ever since he finished his training. He now owns his own garage and auto agency. When Smith came to me he knew nothing about autos. In eight weeks my methods made a big-money man out of him. And there's no reason why any boy can't do just as well.

I'll Pay Your Railroad Fare to Cincinnati and Board You for My Full 8 Weeks Term

I get calls every day from garages, battery stations, auto factories and so on, for McSweeny-trained men. Albert Boyer, of Alexandria, Ky., is only 19 years old, but has been making a big success in his own business. He says my training made him win out. To fill the calls on me for trained experts, I'm making this wonderful offer for a short time. I'll pay your railroad fare to Cincinnati, and board you for the full eight weeks.

In 50 Days You're Ready to Command a Big Pay Job



13,000,000 Autos and 1,000,000 Tractors must be kept running. Spend 50 days in my great shops and no job will be too hard for you. Big wages and steady work certain. "McSweeny training made me Chief Mechanic of a big plant in three months," writes Fred Pendley, Blowing Rock, N. C.

Electrical Course Included

Every one of my students receives a complete course in practical electricity. He learns ignition, starting, lighting, power plant and generator wiring—all by the same work-shop job-methods which teach him all about carburetors, transmissions, vulcanizing, battery construction and repair. He learns in 50 days to tackle any machine, in any condition, and "put it on its feet".

"Mac" Trains Men With Tools—Not Textbooks You Learn Under Experts in a Wonderful Shop

"The Great McSweeny School"

I have successfully managed more auto and tractor schools than any man in the world. Now I am in complete control of the former Rahe Auto & Tractor School, of Cincinnati, Ohio. Now I can put into complete operation many ideas and plans which, I sincerely believe, will make this the greatest Auto, Tractor and Electrical training institution in existence. Write me and I'll tell you what this splendid school can mean to YOU, to your pay envelope and to your future.

Write Today for Free Catalog & Special Reduced Tuition Offer for McSweeny Life Scholarship.

McSWEENY

Auto, Tractor & Electrical

NINTH & WALNUT STS. SCHOOL CINCINNATI OHIO

Successors to Rahe Auto & Tractor School

McSweeny Auto, Tractor & Electrical School
Dept. 144, Ninth & Walnut, Cincinnati, Ohio

Send me your Big Free Book on auto and tractor business, and send me information on special reduced tuition offer, in effect for a short time only.

Name .....

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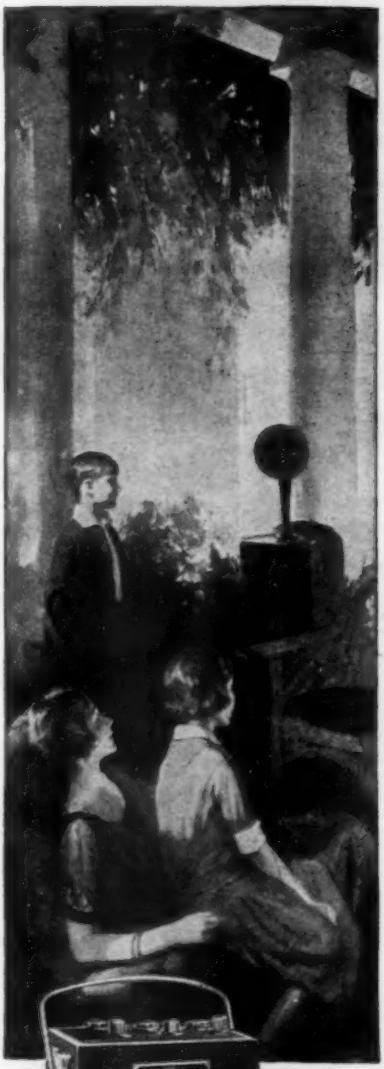
City or Town ..... State .....

(No facilities for colored students)

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"



Get ready *now* for summer radio

A GREAT radio summer is at hand. To enjoy summer radio at its best, equip your receiver with the best batteries you can get. Put in new Eveready Radio "B" Batteries and see what wonderful, long-lived service they will give.

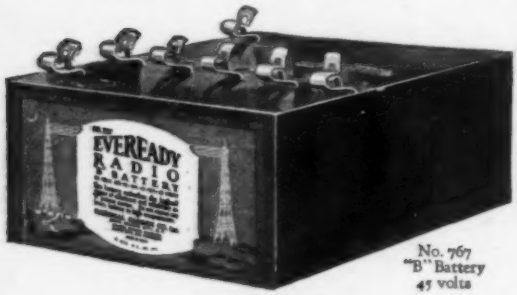
Made especially for radio use, Eveready "B" Batteries will operate the loud speaker at maximum volume for long or short periods, depending on how rapidly the current is taken out of them. Packed full of pep and punch and go, Eveready "B" Batteries pour out their power the moment you turn on the tubes.

Eveready "B" No. 767 is the standard amplifier "B" Battery, and gives 45 powerful, dependable, zippy volts. Five sturdy Fahnestock Clips make this big "B" Battery available for detector tube use as well—varying the voltage from 16½ to 22½ as required.

Insist on Eveready "B" Batteries, remembering that they are the product of thirty years of experience and know-how in battery making. For maximum battery economy and service buy Eveready Radio Batteries—they last longer.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco
Canadian National Carbon Co., Limited
Factory and Offices: Toronto, Ontario



No. 767
"B" Battery
45 volts

Storage "A" Battery

No. 766 "B" Battery 22½ volts

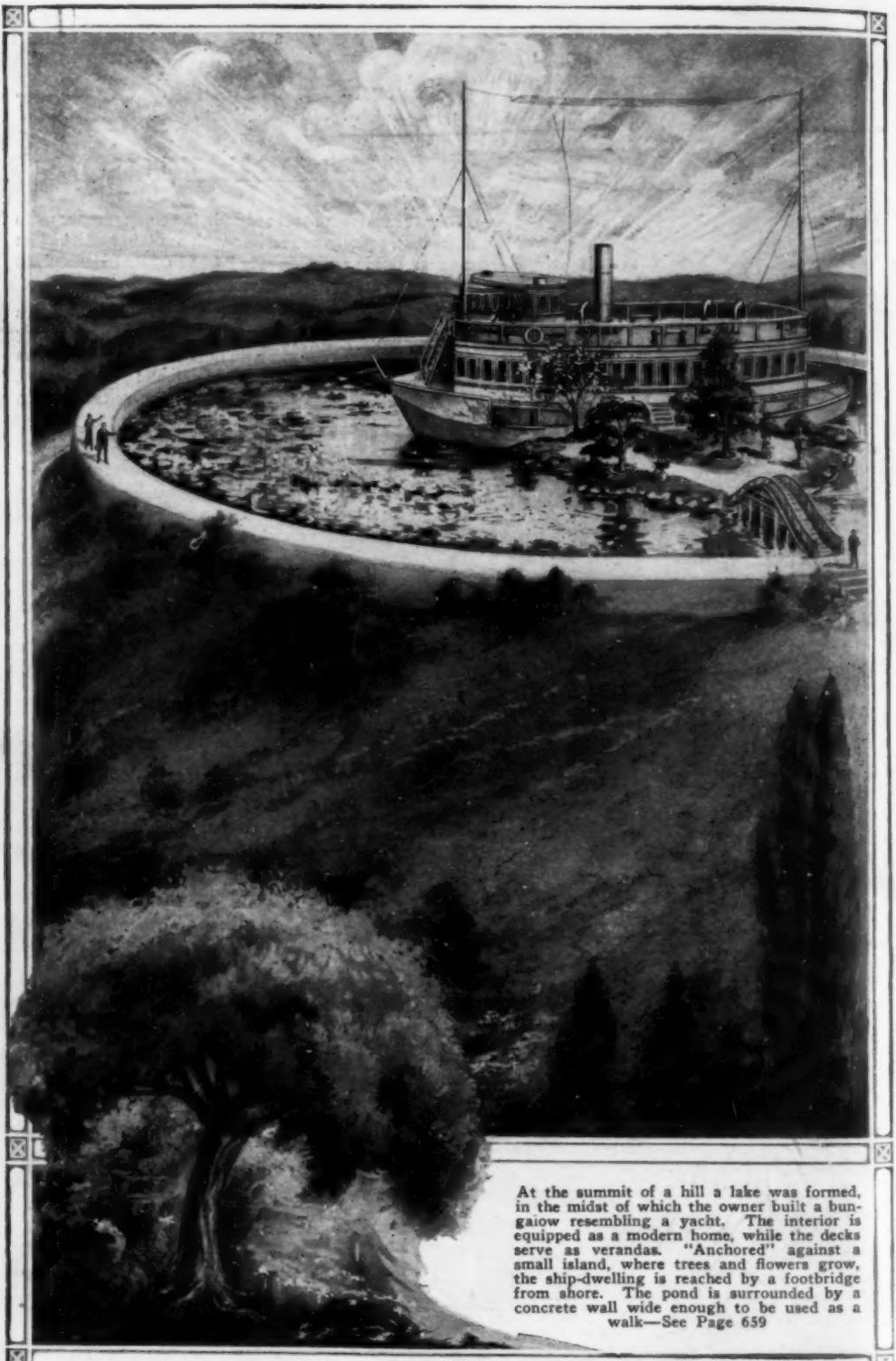
No. 7111 Dry Cell "A" Battery

No. 764 "B" Battery

No. 771 "C" Battery

EVEREADY
Radio Batteries
—they last longer

Informative and money-saving booklets on radio batteries sent free on request. If you have any questions regarding radio batteries, write to G. C. Furness, Manager, Radio Division, National Carbon Co., Inc., 207 Manley Street, Long Island City, N. Y.



At the summit of a hill a lake was formed, in the midst of which the owner built a bungalow resembling a yacht. The interior is equipped as a modern home, while the decks serve as verandas. "Anchored" against a small island, where trees and flowers grow, the ship-dwelling is reached by a footbridge from shore. The pond is surrounded by a concrete wall wide enough to be used as a walk—See Page 659

Popular Mechanics Magazine

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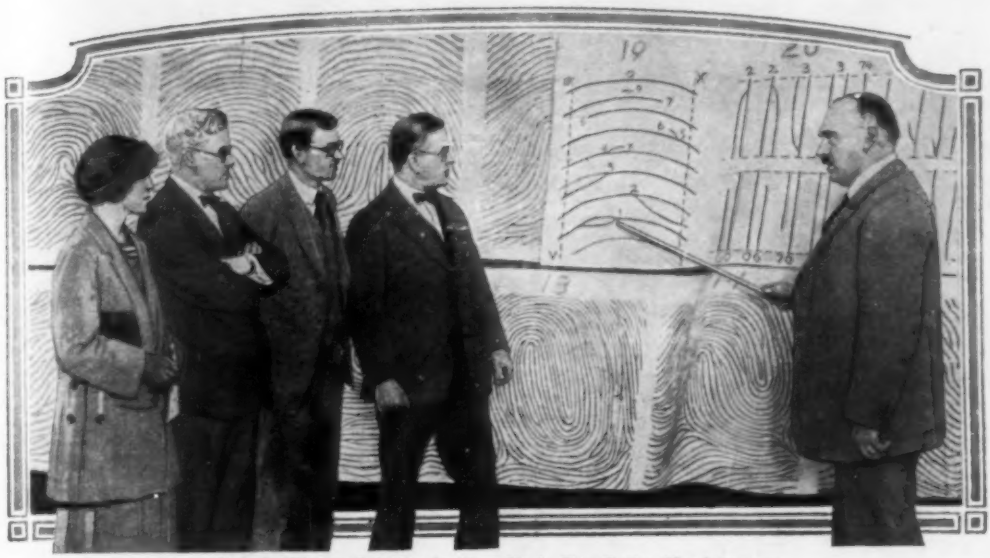

Class in Finger Printing in New York City Police Headquarters

How Science Is Fighting Crime

Master Detectives Now Turning to Chemistry, Medicine and Laboratories to Balk and Catch Lawbreakers

WITH the passing of the old-time detective, whose chief reliance was a quick wit and a power of deduction, there has come forward the expert criminologist, with his chemical retorts, psychological tests and dozens of other scientific inventions and discoveries at his beck and call.

Today the master detective employs devices and methods not dreamed of a quarter of a century ago, not only in identifying and apprehending the felon, but also in safeguarding property against the firebug, forger, swindler and thief. He is compelled to because the criminal, too, keeps abreast of the times. Each month discloses some innovation which the criminologist must meet, detect, and combat. And so the fight is waged back and forth across the chessboard of crime, endlessly, it is true, but ever approaching nearer and nearer the ideal situation when scientific law enforcement will have checkmated the criminal at every turn and the way of the transgressor will have been made not only hard but impossible. Then, too, the modern criminal is of a higher type than ever

Detective with Reflecting Telescope Hidden in Book to Trap Train Thieves

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Making Photographic Reproduction of Pistol in Laboratory Filled with Crime-Detecting Apparatus

Finger-Print Camera Which Is Equipped with Small Electric Bulbs before the Lens

before and a thousand and one conveniences aid him as well as his pursuers. A recent survey made by Johns Hopkins university shows that, on a percentage basis, college men land in prison as often as their uneducated brothers. The investigators, however, found not one college professor or scientist behind prison bars. For the most part the crimes of educated men were forgery and financial cheating in some form, the offense being committed at the age of 40 or later because they had proved failures financially in professional life. But it was found the college-bred man rarely serves two terms. One sentence is enough to convince him that crime doesn't pay.

Aside from the prevention of crime and detection, which embraces capture, identification and consequent conviction, the criminologist today also covers the field of penology, which deals with deterrent factors and reformation. But, for instance, in the case of the murderer, the problem of prevention is rarely brought up, for veteran police officials have found that an overwhelmingly large percentage of homicides could not have been prevented by police work, however efficient and diligent. So in this case the problems are detection, capture, identification and conviction.

Street cars, interurban lines, railroads, automobiles and boats—even airplanes—may place the slayer miles from the scene of the crime within a few hours of its commission. But he must pause somewhere, and there the finger of the law is laid upon him by telephone, telegraph, cable, airplane, and even radio. As soon as the crime is discovered, every agency at the command of the authorities is brought into play within a few moments. The word is flashed to headquarters and finger-print experts, photographers and coroner's physicians are rushed to the scene. Photographs are taken of the room showing the position of the body, the wounds, the slants and directions that bullets have taken and the position of furniture. The finger-print expert scurries about dusting white powder on every object which the slayer may have touched.

Detectives rush to headquarters with the negatives and within an hour experts at the card-index files are hunting through hundreds of thousands of records in search of that particular finger print. If it is

there it takes an expert but a few minutes to pick it out from perhaps 20,000 other similar patterns of loops, arches and whorls that appear almost identical to the layman.

If the print is found on record a description of the killer is flashed to every police station in the city simultaneously over a ticker system. Within a few minutes every uniformed policeman is engaged in the man hunt, scrutinizing every passerby, peering into taxicabs, watching street cars and railroad terminals. If the print is not of criminal record, it is held against the day of the apprehension of the fugitive to be used in identification. But perhaps the murderer has escaped to another city. He finds another man hunt on there, for a description of him has been telegraphed to every large police center, with his finger prints following by mail. It is possible now to telegraph a likeness of him, accurate enough to lead to identification, but this agency has not been perfected to the point of being in common use. There have been several instances in which radio has been used successfully.

As a Result of the Use by Bandits of High-Powered Automobiles, the Police of Several Cities Have Turned to Airplanes to "Spot" the Fugitives

Perhaps the fugitive has barricaded himself in a house or other refuge and, plentifully supplied with ammunition, plans a desperate resistance. The days when a barricaded maniac could mow down policemen with pistol or rifle have passed. Today the police are equipped with steel, bullet-proof shields mounted on wheels, behind which they crouch and which they push toward the desperado's stronghold. Once within hurling distance, they throw tear gas bombs into the barricade and the criminal is carried to the prison hospital on a stretcher. Guns which discharge gas also are used, but they are effective only at close range, and have not proved as successful as the bombs.

Suppose the slayer is captured but denies his guilt. Then science is called in to fasten guilt. Dactyloscopy, or the use of finger prints, is the means most generally used for identification purposes. Finger prints have almost entirely superseded the system of measurements which is efficacious only in the cases of adult males.

It is of little use with adolescents or women with heavy heads of hair, as it has been proved that as many as three criminals possessed identically the same Bertillon measurements and looked so much like each other they could not be distinguished apart by their photographs. On the other hand, finger impressions remaining on objects for a period of three years have been successfully photographed and identified. Dr. Icard, a French criminologist, has suggested the injection of paraffin beneath the skin of habitual criminals for identification purposes. When injected in the fluid state, paraffin leaves a hardened tissue like a scar, a lump which never disappears even after the paraffin has been absorbed. If injected as a solid it produces the same result. Dr. Icard suggested placing the mark on the edge of the right shoulder blade, at various heights for different types of crimes, thereby enabling a police officer, by running his hand over the back of the suspect's coat, to immediately classify him.

A single hair left by the slayer in the clutch of his victim may serve to establish his identity. An expert can immediately identify the hair by its uniform diameter and pick out its owner by the number of scales upon it. An adult's hair can easily be distinguished from that of a child by the fewness of scales upon the latter. With the oscillograph, a machine built in the laboratories at the University of Michigan, it is now possible to photograph the human voice and differentiate it from that of any other person as easily as is done with finger prints. The apparatus is a combination light plant, telephone and photograph gallery, all encased in a box two feet long, eighteen inches wide and ten inches high. A small but powerful electric arc light throws a beam of light about the size of a lead pencil against a minute glass prism. This refracts the beam to the back end of the box where it strikes a small cell filled with oil in which is suspended a mirror almost too small to be seen with the unaided eye. By the use of a telephone transmitter this mirror turns sound waves into light vibrations which are recorded on the photographic film. The result is a jagged or rounded "graph" depending for its shape and height upon the timbre of the voice. No two persons, speaking the same words, will produce identical photographs.

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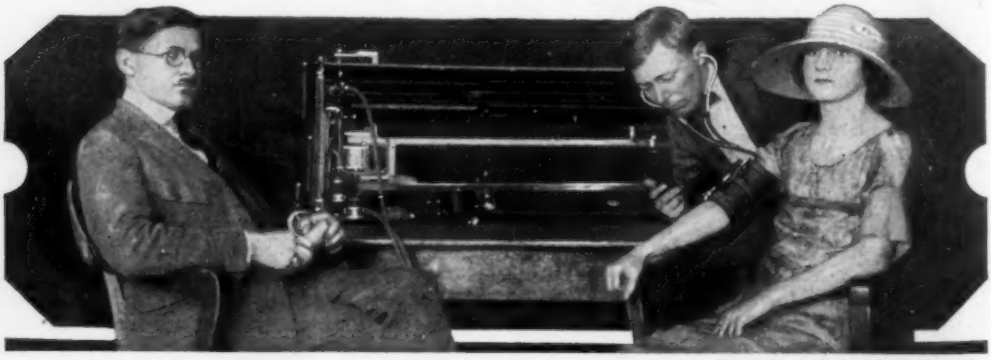
Bullet-Proof Glass Used in Bank to Protect Vaults from Attacks by Robbers

Various devices are used in extracting a confession from the accused, aside from the psychological test of association of ideas, by means of which many an admission has been obtained. A "lie detector"—a machine that is strapped around the prisoner's wrist and registers the truth and falsity of replies through the measured beat of the pulse and varying degrees of nervous excitement—may be used.



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"Lie Detector," Perfected by Former University of California Student, Which Has Been Subjected to Tests by the Police of Berkeley in the Examination of Suspects

LOST AND FOUND PORTS SAVE THOUSANDS DAILY

While people seem to be growing more forgetful, the hurry and bustle of modern conditions have not impaired their fundamental honesty. That is the testimony of the directors of lost and found offices maintained by street-car and taxicab companies and hotels. Last year, for instance, more than 50,000 articles were accidentally left in Chicago's street and elevated cars and turned in to the companies by the finders, mostly employes. One taxi organization reports an average of a hundred "finds" in its cabs every week and its port of missing articles never contains less than 5,000 exhibits waiting to be claimed by their owners. These range from babies to, in one case, a package containing negotiable bonds valued at $150,000. One driver restored a $30,000 pearl necklace to its owner and received a $5 reward. Unless an article is perishable, it is indexed, checked and stored away. If it is not claimed within a certain time, it is returned to the finder. In point of numbers, the umbrella far outranks all other articles among the collections in the lost and found storerooms. In Chicago, the number is estimated at 1,000 yearly. This is attributed to the fact that they are so seldom carried, that they are easily overlooked.

Queer Collection of Articles in the Lost and Found Storeroom of a Street-Car Company

MOVIES SEEN THROUGH "SPECS" JUMP OUT OF SCREEN

Realistic perspectives in screen pictures are said to have been obtained successfully in a double film taken with two cameras and viewed through an instrument somewhat like a stereoscope. In filming the scene, the cameras are adjusted to positions corresponding to the left and right eye. The two films are then combined in one and projected through a machine with a double opening. With the aid of the stereoscopic instrument held to the eyes, this double film is transferred as a single image that seems to jump from the screen.

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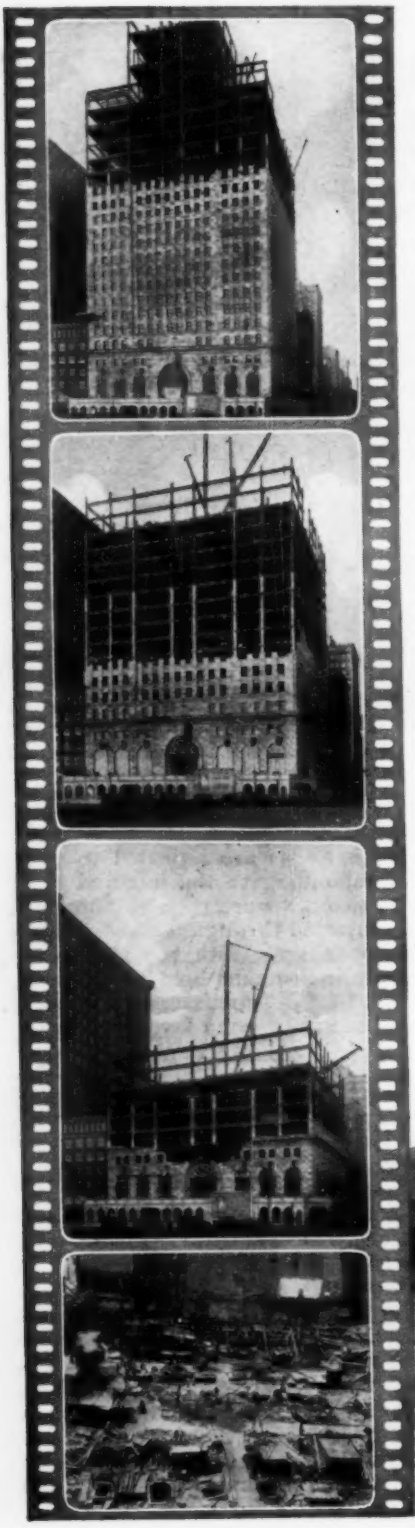
Using Movie Stereoscope that Makes Screen Figures Stand Out with Lifelike Reality

ELECTRIC FRUIT BRANDER PUTS TRADEMARKS ON RINDS

Electric branding irons that put a design or trademark on the outside of lemons, oranges and other fruits are now used extensively by large growers and shippers to identify their product and to guard the buyer against inferior substitutes. As the fruit is packed, it is passed over electrically heated steel dies. These warm the natural wax in the rind and another set of dies, using an inked ribbon, imprint the desired mark. Electricity is also used to kill insects that lurk in the nut sacks. The containers are run through an electric ironing machine, the heat and pressure destroying any eggs.

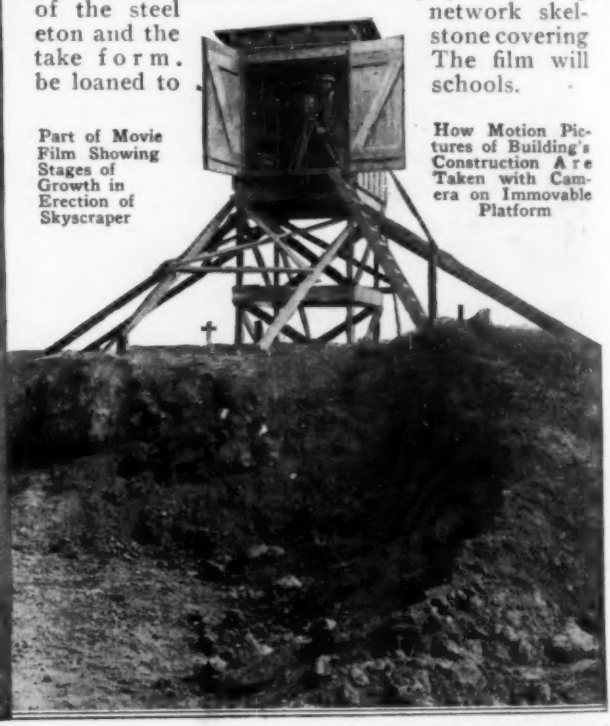


Growth of Skyscraper Shown by Movies

Twenty Minutes of Film to Portray Year's Progress of Big Building

MOTION pictures will show the growth of a skyscraper when the film now being taken of the thirty-two-story Straus building is completed. When finished, it will be possible for motion-picture audiences to see within twenty minutes the progress of the work, from the digging of the caissons to the placing of the last stone at the top of the massive structure. From a special, caged platform erected near the building, a motion-picture operator takes twenty or thirty feet of film every morning. The pieces, when put together, will make a continuous reel, reproducing the various stages of construction and the activities of the craftsmen as they move about in their tasks of "pushing" the structure toward the sky. During the time the camera is in position, it is not permitted to be moved a fraction of an inch, being fastened to the floor of the support. Each day the lens is elevated slightly to include the unrecorded portion of the work on the building. Standing on a rise of ground to command an unobstructed view of the subject, the picture machine sees with unerring eye the lacing of the steel network skeleton and the stone covering take form. The film will be loaned to schools.

Part of Movie Film Showing Stages of Growth in Erection of Skyscraper



How Motion Pictures of Building's Construction Are Taken with Camera on Immovable Platform

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RAILWAY OVER SAHARA DESERT TO SHORTEN STEAMER TRIP

From the boulevards of Paris to Africa's "Ivory Coast," is a journey that now takes a month, but it may be cut to fifteen days if plans of the French government to build a railroad across the Sahara desert are carried out. Preliminary surveys for the project have been submitted after four years' preparation. After voyage by steamer, passengers will board the trans-Sahara express at Oran on the border between Algeria and Morocco. For two days, the line will cross nothing but sand. Two oases will afford the only sight of green things until the Niger is reached. After a ten-hours' ride to Timbuktu, and a further journey to a railway junction, the travelers can complete their trip to the coast countries on lines already built. Finding water supplies and building tanks for storing are important items in the cost of construction.

BULLET-PROOF VEST RESISTS FIRE OF THREE PISTOLS

To demonstrate the effectiveness of a bullet-proof vest he invented, a New York man donned the garment, posed as the target and allowed three policemen to shoot at him at close range. Repeated fire of thirty-eight and forty-five caliber bullets failed to penetrate the vest. The missiles were flattened against the sides of the protector and fell harmless to the ground. Following this demonstration, young women put on the vests and also served as targets.

Inventor, Protected by Bullet-Proof Vest, Withstands the Simultaneous Fire from Three Pistols

STEAMLESS BOAT IS PROPELLED LIKE RAILWAY HAND CAR

By an application of the hand-car principle, a small boat has been made which is propelled by a walking beam that revolves a paddle wheel in the stern. Steering is effected by two levers in the box, operated by the feet when necessary. The boat originally was designed by a one-armed man who could not row and wanted some method of propulsion faster than sculling with one oar at the stern.

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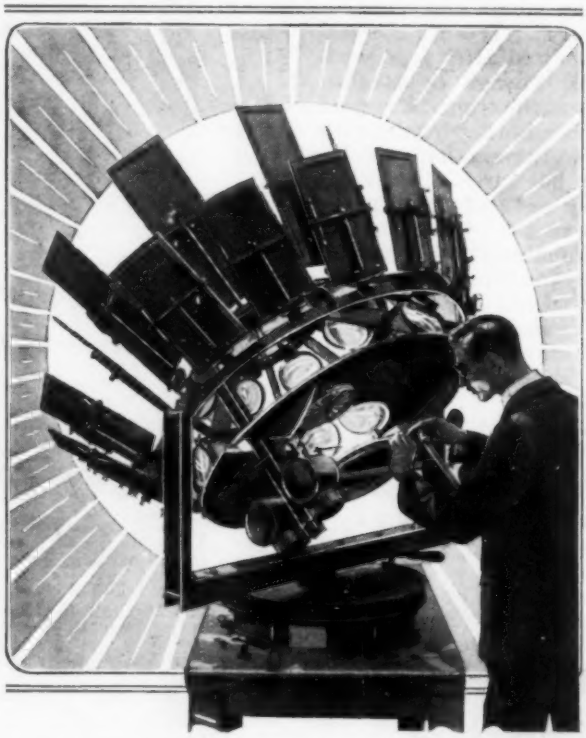
Stern-Wheel Boat that Is Operated by Hand-Car Principle and Is Steered with Feet

MOTOR LOCK AND FUEL SAVER COMBINED FOR AUTOISTS

Combining in one a positive motor lock, fuel economizer and carbon preventer, a simple device has been invented to fit in the intake manifold. It is said also to increase the speed and power of cars and to prevent the stalling of engines in traffic. It may be applied to trucks, motor boats and farm power plants. It is automatic in operation and permits drivers of automobiles to throttle down easily in congested traffic.

SUN'S RAYS ARE HARNESSED IN SOLAR FURNACE

ARCHIMEDES, famous mathematician, is said to have set fire to the fleet of the Roman emperor, Marcellus, by the use of a series of concave mirrors concentrating the sun's rays upon the fleet. John Ericsson, the designer of the Monitor, of civil war fame, constructed several engines having boilers provided with mechanical devices for effecting the necessary concentration of solar rays which, when collected from 100 square feet of surface, effected the evaporation of 489 cubic inches of water per hour, more than equivalent to one horsepower. This is, however, but a small proportion of the potential energy actually developed by solar heat hourly received upon an area of this size. Ericsson estimated it to be equivalent to that caused by the combustion of 200 tons of coal in the same time. To harness this energy, a solar furnace, with which it is claimed it is possible to attain much higher temperatures than that given by the electric furnace, has been built. The apparatus is composed of about twenty-five lenses and mirrors, the mirrors forming the walls of a cone and the lenses arranged to form a dome near the base of the cone. By adjustments the sun's rays are concentrated within an area of about one-quarter of an inch, which is the working part of the furnace. It is claimed that by simply increasing the number of lenses and mirrors increased temperatures may be attained. In tests made with this furnace, the more common metals immediately melted and passed off in gaseous form. Even substances like graphite are unable to withstand the intense heat. The working part of the furnace is, of course, extremely small and can handle samples of not over two grams in weight. One of the advantages claimed for this apparatus is that substances can be melted or evaporated in a vacuum, as they may be inclosed in a glass vessel. It is believed that a furnace of this sort can reach temperatures sufficiently high to melt substances that up to the present have been considered infusible.



Solar Furnace, Built of Mirrors, to Harness Sun's Rays and Obtain Temperatures Higher than Is Possible with Electricity

ONE-COLOR PLAN FOR TRAFFIC TO PROMOTE SAFETY

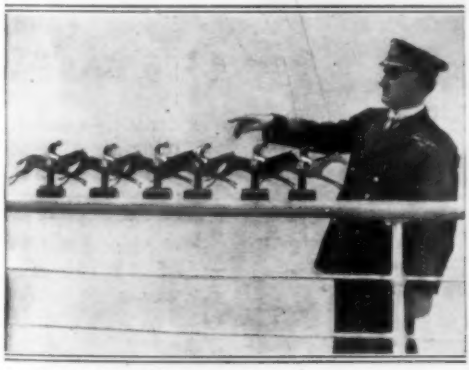
To increase the safety of driver and pedestrian on the highways of the nation, a group of men appointed by the American engineering standards committee, have begun the preparation of a uniform set of code and color signals for the guidance of motorists and others in all parts of the country. It is pointed out that various colors and styles of lettering are used on warning signs and that many accidents are caused by the resulting confusion. The plan is to have all highway signs conform to a single scheme in color, wording and legend and all electric traffic lights be made uniform so that "Stop" and "Go" signs will be the same in every section of the United States. The use of three colors, red, green and yellow, as principal traffic-control lights has been found successful by the railroads, and their experience is to be considered in formulating the new code.

SHIP THAT SAILS ON HILLTOP IS HOME OF ITS OWNER

Modeled closely after regulation motor-yacht lines, but anchored on a concrete base in an artificial lake on the commanding brow of a hill, a unique home has been built in Oakland, Calif. This ship-bungalow is in the form of a double-decked pleasure craft, fifty-four feet in length. It will be moored perpetually to a small island in the lake while it carries its owner on happy cruises through dreamland. The superstructure is of wood, the hull of concrete. Five comfortable and handsomely furnished rooms comprise the interior. There also is ample deck space on all sides. The top of the main cabin forms a wide promenade. The galley is a regulation bungalow kitchen. The upper deck, smokestack, ventilators, running lights at night, deck chairs, life preservers and two twenty-five-foot masts carrying a "sea-going" radio aerial, all add a remarkable amount of realism. When a larger mansion is completed, the ship will become a den.

HORSE-RACE GAME IS PLAYED WITH MODELS ON LINER

For the amusement of tourists on a round-the-world cruise, the captain of a liner has devised a deck game that is played with small, wooden models of horses. These are moved along the rails by the



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Models of Horses Used in Playing New Deck Game Around the Rails of Liner at Sea

players. Many players can take part in the game, which also usually attracts a large number of spectators.

¶In the Bank of England the "grand balance" or scale used is so sensitive that the weight of a postage stamp moves the index six inches.

DUCK BLIND THAT CAN'T SINK HAS COMFORTS OF CAMP

So a hunter can stalk his prey in comfort and safety, a nonsinkable duck blind,

Hunter in Nonsinkable Duck Blind that Can Carry Extra Provisions and a Stove

invented by a Washington, D. C., nimrod, provides room for provisions, extra decoys and gun shells. A small heating stove can also be carried in the device, which is designed to remain upright even when the occupant's weight is thrown against one side. When disguised with tree branches and grass, it furnishes a cozy and effective concealment for the shooter.

ARMY GAS AS CURE FOR COLDS TESTED BY GOVERNMENT

Colds, bronchitis, whooping cough and influenza are being treated by the medical research department of the chemical warfare service by the administration of small amounts of chlorine gas. In tests on 900 patients, seventy-five per cent were reported cured, and of the remaining twenty-five per cent, four-fifths were said to have shown improvement. A small device for releasing minute quantities of the gas is installed in a room, the fumes being circulated by an electric fan. An hour's treatment usually is sufficient to cure the most severe colds, it is asserted.

Word at Every Touch Written by Machine

Woman Stenographer's Invention Does Away with Code in Taking Dictation Faster than Anyone Can Talk

TO permit the writing of an entire word at a time, a machine has been invented by an Atlanta, Ga., stenographer that is somewhat similar to the typewriter in operation. Its purpose is to enable an operator to take dictation, court testimony, or public speeches without shorthand. It writes one word to a line on a strip of paper like that used in an adding machine. The writing scale is only eighteen spaces wide. Any ordinary word can be written by pressing the keys just once. If the word is too long, or too involved, however, it must be written by syllables. It is not a typewriter, however, and does not propose to take the place of one. What the inventor, Miss Edna C. Robeson, claims for her invention is that it is a means by which the operator can write faster than anyone can speak.

The advantages of the machine over shorthand, as explained by the inventor, are that it can be learned at once, while shorthand takes weeks of study; it writes out the complete words without employing a code of any sort; and anyone can copy the record which enables a court reporter to continue at his work while someone else transcribes his record of testimony. The working model of the machine weighs about six pounds and is the size of a portable typewriter. It is built solidly to eliminate vibration and to deaden noise. All the parts are inclosed, but there are not many of them. It is a simple machine, inside and out. The keyboard is just wide enough for two hands to cover naturally. In writing, the hands are put on the keyboard with the thumbs in the middle. Under the thumbs are the vowel keys. All the vowels are there twice, except the U, and there is a third E, at the right. Under the fingers—on each side of the vowels—are the consonants. There is one complete set of consonants under the left fingers and another under the right. Some appear twice at the right.

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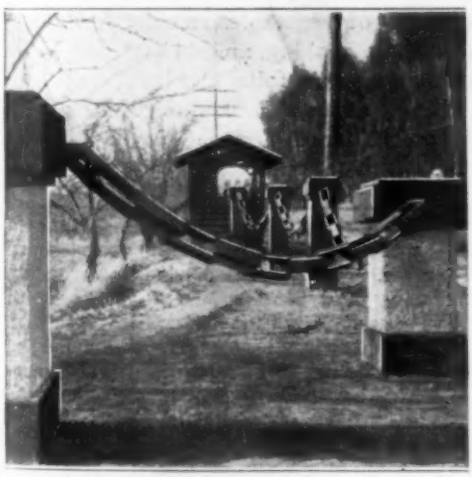
In addition to the writing machine, Miss Robeson has secured, or has applied for, patents on fourteen inventions. Among them are a typist's chair, a visible card system, a stationery cabinet, a paper fastener, a couple of lock washers and an automatic tension for printing presses.

FENCE CHAIN OF WOODEN LINKS INCLOSES LARGE ESTATE

Inclosing the grounds of a large California estate, a fence consisting of a huge chain of wooden links stretched between concrete posts is one of the objects of interest to tourists in the region. Each length of the chain is attached to a cap on



Wooden-Link Chain Fence Forming an Impressive and Ornamental Entrance to California Estate

the post by a metal clasp fastened to the wood. As the links are made of well-seasoned boards, it is believed that the barrier will remain in service for many years.

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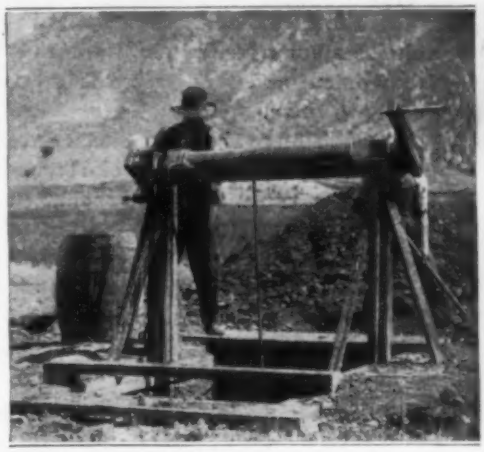

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Word at Every Touch Written by Machine

Woman Stenographer's Invention Does Away with Code in Taking Dictation Faster than Anyone Can Talk

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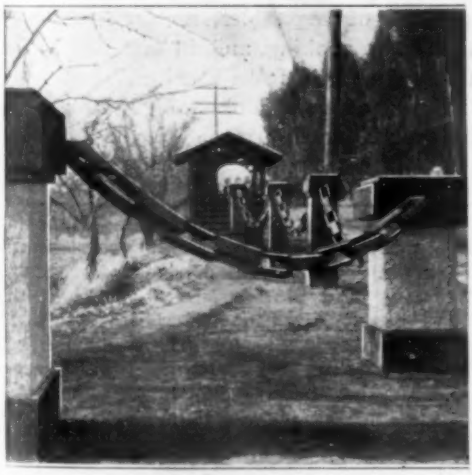

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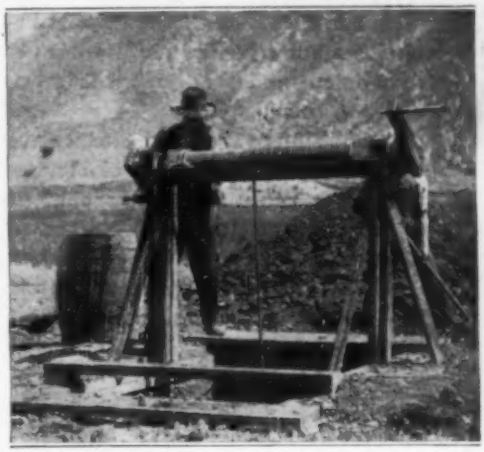

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To Our Women Readers Especially

WE are constantly reminded of the fact that this magazine includes among its readers, thousands of women, and this appeal is especially to them.

In addition to the magazine, we are constantly bringing out books "written so you can understand them," of a helpful, constructive character. Thousands of letters from readers who have made things from the directions given in these books attest their usefulness.

For several years we have had in mind the publishing of a "Popular Mechanics Cook Book," and nowhere can we hope to look for better recipes for cooking than to our own women readers.

We ask you, therefore, to send us at least one recipe for bread, biscuits, pies, cakes, soup, jellies, preserving, candy, soap, etc., which you consider your very best. Also household hints on things one can do to make the home more comfortable and convenient. Just as soon as these recipes are received and compiled, the book will go to press, and in return for your help each contributor will receive a copy of the cook book free. Unless requested not to do so, we would like to print the name and town address of each contributor.

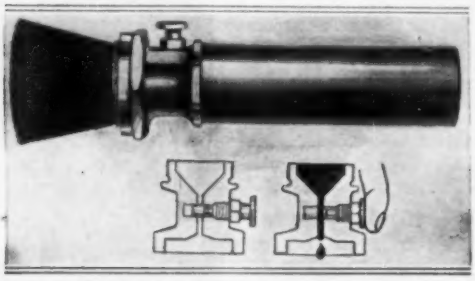
It need not be a recipe you have originated yourself, but one you are fond of using. In many cases these will have been handed down from mother or grandmother. Or, perhaps, secured from some friend. Anyway, it will be your very best. Just imagine what a thousand or two very best recipes will mean! In case of absolute duplications, the first received will be used, but every woman who sends a recipe will receive a copy of the book. Also tell us where the recipe originated.

And don't forget the preparing and cooking of vegetables, meats, fowl, fish, camp cooking, and, in fact, anything your men folks like best.

Please address Cook Book Editor, 200 East Ontario Street, Chicago, Ill.

BRUSH FOR MARKING PACKAGES HOLDS INK IN HANDLE

For marking boxes and packages, a brush with a handle that contains a supply of ink has been invented. Several hundred inscriptions may be made with one filling, the ink being released by the turn of a screw. The feed regulator prevents smearing and blotting. The brush is of good quality so that a legible signature may be written. With this marker, a bothersome ink pot or pan is unnecessary.



Package-Marking Brush and Diagram Illustrating how Ink Is Fed to Bristles

STARS ARE STUDIED FROM CAVE

From an underground, concrete observatory which he has constructed on a hillside at his country estate, James Hartness, former governor of Vermont, pursues his studies in astronomy unaffected by bad weather. The observatory is connected to the house by a 200-foot tunnel and contains a laboratory, office study, retiring and storage rooms. The telescope is mounted on a revolving cast-iron turret at the extreme end of the passage.

A Group of Engineers Examining Brake-Testing Apparatus Developed at the Bureau of Standards

What to Expect in the Car of the Future

Engineers Forecast Lighter and More Powerful Motors Which Will Cost Less and Give Greater Comfort

LIGHTER, more powerful and comfortable cars, that will cost less, run further without adjustment and will be easier to handle, are being forecast by automotive engineers.

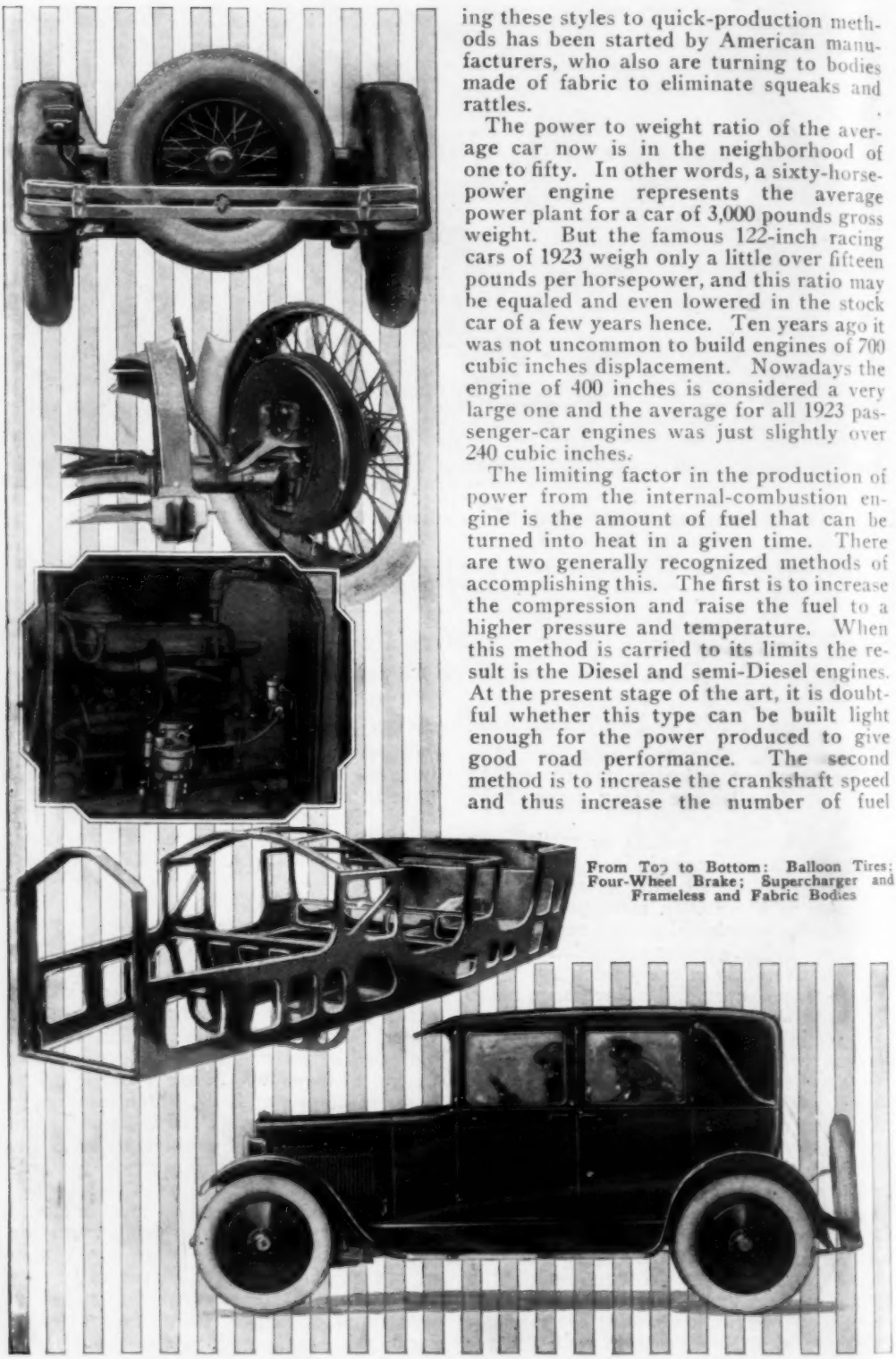
Bodies without squeaks or rattles and finishes that will remain new even after years of the hardest kind of service also are seen as more than mere possibilities. Despite the wonderful service rendered by the car of today, greater perfection is being sought constantly in every line.

In Europe automobiles have been made to run as far as eighty miles to the gallon of gasoline. Supercharging, or forcing the gas into the cylinders instead of allowing it to be drawn in by the suction of the piston, has enabled the weight of the motor to be cut down and resulted in performance undreamed of a few years ago.

With this device a motor can be made small enough to give the greatest economy in city driving and yet, at the touch of a foot on a pedal that brings the supercharger into action, it will leap to a ninety-mile-an-hour speed. Reduction of the weight also means less wear on the tires and a consequent lower cost for replacements—a vital consideration with the average owner.

"We can manufacture motor cars that will never have carbon in them and I believe we can build them so that oil will have to be drained only once a year," declares Charles F. Kettering, head of the General Motors Research corporation. "As to the finish, this has been so perfected that we can now positively guarantee that an owner can leave his car standing out all year, and, at the end of that time, it will look the way it did when bought. Motors with new types of cooling systems are coming, with new valves, gears, carburetors and a thousand and one other things, which make them operate better with present-day fuel, to say nothing of the changes which are possible when some of the newer fuels, which are now in process of commercial development, are made universal. I believe a third of the weight can be cut out of the present-day cars."

Great changes also are forecast in closed body design—the getting away from the top buggy and its side curtains. Foreign manufacturers already have perfected several almost ideal convertible type bodies that can be turned from open touring cars into weathertight sedans, but these have been built regardless of cost. Adapt-



From Top to Bottom: Balloon Tires; Four-Wheel Brake; Supercharger and Frameless and Fabric Bodies

ing these styles to quick-production methods has been started by American manufacturers, who also are turning to bodies made of fabric to eliminate squeaks and rattles.

The power to weight ratio of the average car now is in the neighborhood of one to fifty. In other words, a sixty-horsepower engine represents the average power plant for a car of 3,000 pounds gross weight. But the famous 122-inch racing cars of 1923 weigh only a little over fifteen pounds per horsepower, and this ratio may be equaled and even lowered in the stock car of a few years hence. Ten years ago it was not uncommon to build engines of 700 cubic inches displacement. Nowadays the engine of 400 inches is considered a very large one and the average for all 1923 passenger-car engines was just slightly over 240 cubic inches.

The limiting factor in the production of power from the internal-combustion engine is the amount of fuel that can be turned into heat in a given time. There are two generally recognized methods of accomplishing this. The first is to increase the compression and raise the fuel to a higher pressure and temperature. When this method is carried to its limits the result is the Diesel and semi-Diesel engines. At the present stage of the art, it is doubtful whether this type can be built light enough for the power produced to give good road performance. The second method is to increase the crankshaft speed and thus increase the number of fuel

sucking strokes per minute. For any size cylinder at any given speed, the power output will increase directly as the pressure on the piston is increased. To get this high pressure it is necessary to increase the compression. Supercharging is nothing more than increasing the compression by forcing the fuel into the cylinder at a pressure above atmospheric, instead of decreasing the distance between the top of the piston and ceiling of the combustion chamber. Supercharging is a reality and is now used on a prominent German stock-car engine.

In the consideration of high compression, turbulence must not be overlooked. To the layman this is something indefinite, nevertheless it is considered one of the greatest factors in making high compression possible. Briefly stated, a turbulence combustion chamber is one so constructed that the gas mixture is given a swirling motion. When ignition occurs the part of the charge initially ignited imparts its flame to the unignited portions with the result that the time interval required to burn all the gas is materially reduced. By a queer coincidence this faster burning allows a higher compression without premature ignition or detonation.

Such parts as pistons, crankshafts, cylinder walls, and bearings, also, will undergo considerable improvement in the future. It has been proved that a high efficiency engine can be operated at full load for 500 hours without breakage. Strangely, however, the parts that show the most wear on such tests are not bearings and valve mechanism as was the case a few years back. Cylinder-wall and piston-ring wear are the two biggest items that balk the designer in his efforts toward extreme durability. A new development is the air cleaner, one of the big steps forward in the attempt to increase the life of cylinder walls and piston rings. It has been proved that much of the deposit in engine cylinders comes from common dust and sand which have entered through the air intake. Six American passenger cars are now using air cleaners on their carburetors and there is every indication that the number will be increased.

Greater power and durability call for a body and chassis built as light as possible consistent with strength and comfort. To meet this demand it is proposed to construct the frame of light alloy on the principle of the sectional bookcase. This type of construction will enable great economies in production and the car can be shipped knocked down to be assembled by the dealer or owner.

MOTORCYCLE AS FIRE ENGINE SPEEDS FIGHT ON FLAMES

Before heavier apparatus can reach the scene, a speedy motorcycle equipped with hose, extinguishers, an ax, pike pole, broom, two fire guns, and two firemen, roars from a station of the Chicago fire department in answer to alarms. This efficient fire engine is sufficient to cope with minor blazes and often makes it unnecessary to haul out the more ponderous equipment.

Motorcycle Fire Patrol Equipped and Ready for Quick Dash to Scene of Blaze

NONSINKABLE BOAT IS DRIVEN BY SMALL GAS ENGINE

Air compartments built into an Italian motor boat make it nonsinkable and pontoons on each side keep it from upsetting. A small gas engine provides the power. Accommodations are provided for several passengers, but the advantage claimed for the craft is its safety for navigation.

Nonsinkable Motor Boat, Built for Navigating Italian Rivers, that Cannot Upset

BAKING AS CURE FOR DOG ILLS IS TRIED IN GERMANY

Ills of dogs are being treated by baking in Germany. For this purpose, and to aid in scientific research, gas ovens have been

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Dog Being Baked in Gas Oven as Cure for Its Ills and to Aid Medical Research Work

installed in the Berlin veterinary university's clinic. The application of heat to animals is said to act in the same way that a steam bath does to the human body.

NINE HUNDRED PIES EACH HOUR TURNED OUT BY MIXER

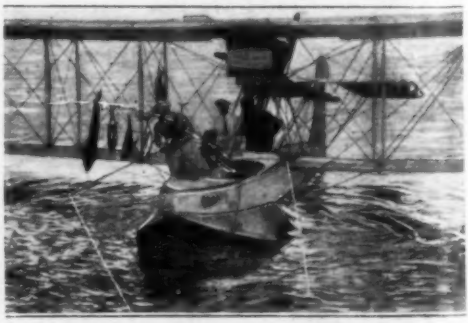
Making pies at the rate of fifteen a minute without the aid of human hands, is the work of a patented mixing machine. The layers of dough are placed in the tins, the surplus trimmed off, supplied with filler, and the edges crimped before the articles are delivered to the finishing table of the machine. The different materials are first placed in hoppers from where they pass to the mixing chambers. Several kinds of fillers can be stored in the reservoirs at one time, and, as the pans containing the lower crusts travel through the conveyor, they are automatically stopped under the various compartments to receive supplies of flavoring matter. The number of each variety is determined by an operator who sets mechanical adjustments to control the volume. A series of rapidly moving rollers presses the dough into sheets from which the layers are cut. Trimming removed from the edges of the pans is carried by a device back to the mixer where it is included with the fresh material.

BULBS IN FIBER FLOWERPOTS ARE SENT THROUGH MAIL

Packed in strong, wood fiber pots, assortments of bulbs have been prepared into attractive gift packages. The bottom part of the carton in which each bulb is placed may be cut off and used as a jardiniere in which to place the pot. Figured designs on the cases add to the beauty of the flowers. The bulbs come packed in a moss fiber and need only an occasional wetting, warmth and sunlight to make them bloom. This arrangement simplifies the cultivation of a window-box display and eliminates the breaking of crockery pots.

FLYING FISHERMEN USE PLANE IN SPYING OUT PREY

Fishing from seaplanes has become a popular sport on the west coast among amateurs, following the lead of professional fishermen who have used planes for some time. According to a report issued by the bureau of fisheries, a seaplane moving 3,000 feet above sea level, about eight



Party of Amateurs Fishing from Seaplane on the West Coast and Part of Their Catch

or ten miles from shore, can locate fish easily. At San Diego last year approximately 10,000 tons of fish were landed without the use of aircraft. This year it is believed that there will be about twenty-five per cent increase because of the use of scout planes. Recently a party of amateurs spied a school of albacore from their aircraft. The pilot descended and a good catch resulted.

AUTO RUNNING ON TEST STAND TO DETECT ILLS

Motor-car troubles of nearly every sort are accurately detected by a set of meters and testers attached to a stand upon which the car is run. The need for valve grinding, new piston rings, cylinder reboring, carburetor adjustments or other repairs is quickly shown. Included in the equipment are devices to measure the horsepower delivered to the rear wheels, gasoline consumption, and the movement of the oil. The diagnosis is made in less than an hour and removes all uncertainty as to the source of troubles.

Giving the Car's Machinery a Thorough Testing with Accurate Meters and Gauges

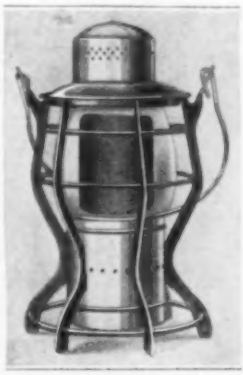
WOOD SAFETY TONGS PROTECT HANDS FROM WRINGER

To protect the hands from injury and to insure them against the roughening effects of water, a pair of wooden safety tongs have been made. They may be used to advantage in feeding clothes into a wringer as well as lifting scalding garments from the boiler. The knobs on the ends prevent the arms from catching between the rolls and feeding in the fingers.

Wooden Tongs for Feeding Clothes into a Wringer without Danger of Injury to Fingers

TWO-IN-ONE LANTERN CHANGES FROM RED TO WHITE

Equipped with an adjustable colored shield inside the globe, a lantern that can be made to furnish either red or white light has been invented by an eastern man. For a danger signal, the fabric shield, manipulated by a lever, is raised and forms a brilliant filter for the rays. It is quickly lowered when the ordinary light is desired. The lantern burns continuously from twenty to thirty hours and cannot be blown out accidentally.



¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

Flood-Lights Revealing Beauties of Night

More than Twenty Millions of Dollars Spent in Year to Illuminate Outside of Nation's Buildings

FROM the time primitive man stumbled about in the darkness with a torch to the modern electric age, human ingenuity, in banishing night by artificial illumination, has developed until today it has reached a brilliant climax in the art of flood-lighting. Assembled in batteries and focused on towers, monuments and lofty sky-scrapers, great masses of electric lights serve as an aid to advertising and to emphasize architectural beauty. Last year, it is estimated that nearly $20,000,000 were spent in the United States alone for flood-lighting equipment. Owners of structures that have been transformed into luminous beacons, visible for many miles, by the floods of light with which they are nightly bathed, frequently pay more each month for current to light the outside of the building than they do for the electricity used in the hundreds of offices occupied by the tenants. It costs approximately $125 each night for the flood-lighting on a Chicago sky-scraper. Here, from darkness to midnight throughout the year, 475 powerful lamps, with an estimated total of 22,000,000 candle-power, turn the building into a white shaft that can be seen fifty miles away. To achieve the best results, electricians seek to cover every square inch of surface of a structure with "shingles" of light. The brilliant beams

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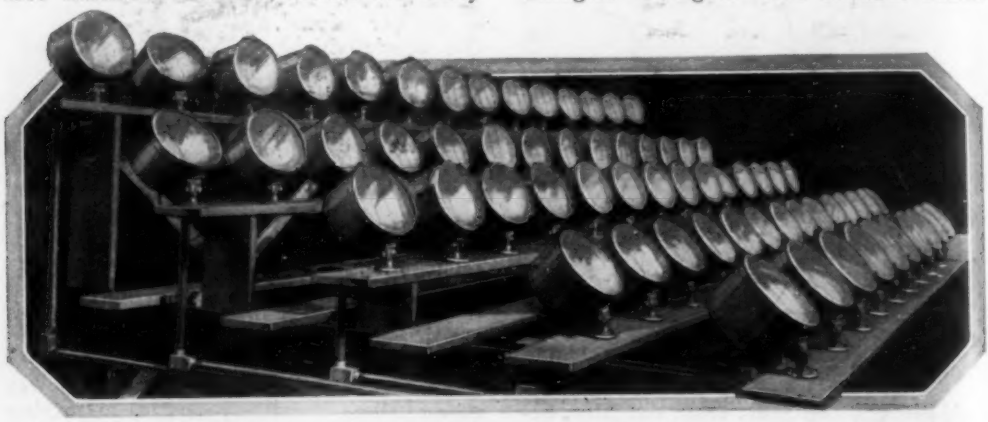
Gigantic Figure of Idol with Flood-Lights in the Eyes to Add Weird Touch to a Motion-Picture Scene

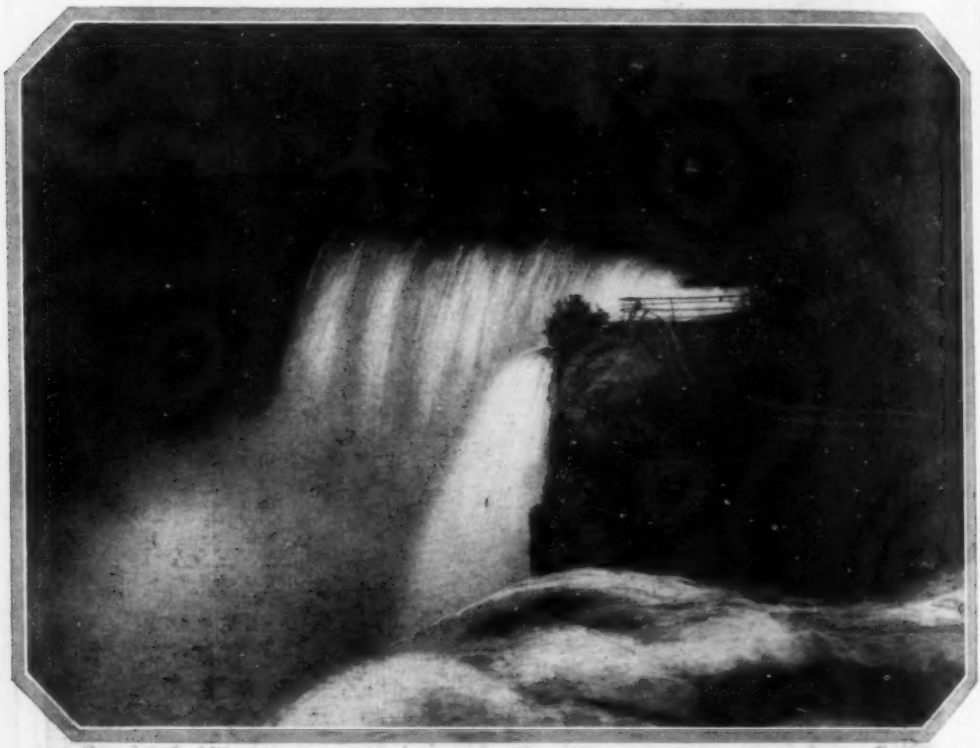


One of Several Batteries of Lamps that Pour Their Floods of Light upon a Large Office Building; Each Lamp Projects a Fifty-Thousand-Candlepower Beam

Copyright, Harris & Ewing

Reflected Back by Rain-Swept Streets, the Shining Dome of the Nation's Capitol Takes on a New Beauty When Bathed in a Flood of Mellow Light

are projected in condensed shafts with a spread of only a few degrees. The shingles, or spots of light, are made to overlap and blend, and the lamps are adjusted so that the maximum illumination, both from the direct rays and from those that rebound from the surface, is utilized. In flooding narrow towers or columns, the method is to surround the object with a field of light rather than direct the rays upon it. Lamps are turned so that the rays shoot upward, surrounding the shaft with a "layer" of light and a luminous background from every angle.



Flood-Lights, Poured upon Mighty Niagara after Darkness Has Fallen, Transform the Walls of Water into Luminous Cascades Visible for Miles

Special flood-lighting equipment has been designed to meet the various problems encountered and improvements are being added constantly. Gas-filled lamps, varying in size from 100 to 500 watts, with highly concentrated filaments, are used on most installations. They are inclosed in steel projectors, similar to automobile headlights, enameled a battleship gray. The lamp is shielded by a heavy wire-glass door. The projector is adjusted to a swivel support so that it can be turned in any direction or angle.

To concentrate the beam, special care is exercised in designing the reflector, which has been so perfected that 330,000 candle-power may be developed from a 500-watt lamp. It is parabolic in shape and consists of a one-piece, mirrored glass, coated with a preparation which will prevent its cracking in the high temperature. The beam usually has a spread ranging from 10 to 25 degrees. For close work, greater diffusion is secured with corrugated reflectors. The lamps are concealed at strategic points on the building or are assembled in batteries, like a park of well-aimed guns.

On the Wrigley building in Chicago, part of the light is projected from a battery of seventy 500-watt lamps on top of a structure across the river and nearly 900 feet away. Permission of the war department was necessary before the lamps could be turned on, as the river is a navigable stream and, therefore, subject to government regulation. Three other batteries, one of eighty-six, another of seventy and a third of ninety 500-watt lamps were placed on a building near by. Nested around the structure, from the twenty-ninth floor of the tower to the sixteenth floor, scores of other lamps of varying size were installed in concealed positions.

Glowing Under the Rays of Lights Estimated at a Total of Twenty-Two Million Candlepower, the Beauty of the Wrigley Building in Chicago Is Enhanced by the Fall of Darkness

BASKET TO CARRY BABY SLUNG FROM SHOULDER

Strapped over the shoulder, a strong reed basket for supporting the weight of an infant in arms has been designed for the convenience of the mother and the comfort of the baby. The carrier leaves one of the woman's arms free and is shaped to hold the child in a secure and easy position. Practically all the weight is placed on the shoulder and a broad strap prevents tiring the muscles or cutting or chafing the skin. The support is adjustable for fixing the basket in any position desired and is quickly attached or taken off by a snap buckle that will not unfasten accidentally.

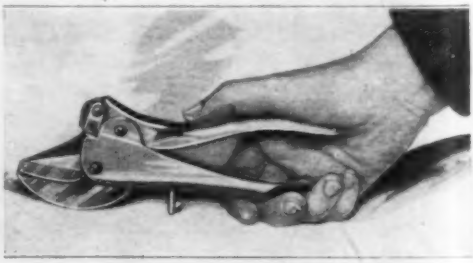
Basket in Position for Carrying Baby and Adjusting the Strap Buckle Which Takes Place of Left Arm and Leaves It Free when Infant Is in Place

PICTURES PAINTED IN BOTTLES SHOW ARTISTS' SKILL

Landscapes, flower gardens and other elaborate designs are painted inside of diminutive glass bottles by clever Japanese artists, skilled in the use of small camel's-hair brushes that have specially arranged handles and tips bent by small lever arrangements to come in contact with the glass after the brush has been inserted. After being dipped in the color, the brush is slipped through the small opening and held in position. By bending the tip, the hairs come in contact with the glass without smearing the rest of the design. A few strokes suffice to trace the details, and the brush is withdrawn for another color. The interior of the bottle is roughened so that the paint will not blur.

POCKET-SIZE PRUNING SHEARS WILL NOT TEAR BARK

Pruning shears operated by leverage applied to the blades from strong grip handles have been placed on the market. They are said to cut much more easily and to require less pressure than the two-bladed variety with long handles that are pressed together. They are small enough to be carried easily in the pocket and do not tear the bark of trees.



Short-Handled Pruning Shears that Cut with "Up-and-Down" Leverage Motion

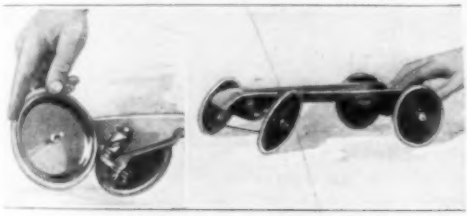
¶In cold weather, Amsterdam traffic policemen and others of the force are able to warm their feet on electrically heated plates built into the sidewalks.

"MOVIES" SAVE JUNKED SHIPS TO SHOW SEA ROMANCE

Valued by motion-picture producers for their artistic appearance as setting for scenes of romance and adventure, several merchant vessels, doomed to destruction by their owners, have been rescued and remodeled, and will put to sea again as playthings for the films. Six battered sail craft, one of them almost half a century old, are being made over in Los Angeles harbor. With their scars concealed by clever "makeup" and their rigging changed, these vessels will play the part of pirate brigs, galleons and stately frigates in screen dramas of the sea.

AUTO WHEELS INCLINED TO AID STEERING, PROTECT TIRES

By inclining both front wheels of an automobile in the direction in which they are turned, a recently patented steering device is declared to lengthen the life of the tires, make possible shorter turns and to afford better traction. For this purpose, the steering knuckles are fitted with an inclined spiral which gives the wheels a graceful turn and keeps the front axle constantly at the same distance from the ground, thus saving wear on the tires.



Automobile Steering Device which Inclines Both Front Wheels in the Direction in which They Are Turned

SULPHUR SPRING IN THE OCEAN FOUND OFF FLORIDA

Samples of sulphur water bursting from a submarine spring in a fissure off the coast of Florida have been taken by government surveyors and sent to the United States bureau of chemistry for analysis. The spring has been known for several years, but its source is still a mystery and the exact chemical content of the waters has never been determined. They give off a strong odor when they reach the air. The water has about the same temperature as that of the surrounding brine, but may be much warmer at the bottom.

FIRE-ALARM CALLS SENT OUT WITH PERFORATED PLATES

By means of perforated plates fitted into the transmitting apparatus in the fire telegraph dispatching equipment of the new central station in the Bronx, New York City, alarms are relayed automatically to outlying stations. Simultaneous signals are sounded in a number of fire houses by means of electric connections formed when current is sent through the plates.

Putting a Fire-Alarm "Record" into Telegraph Instrument that Summons Fighters to Blaze

PATCH GUARDS SOLES OF SHOES AND BARS OUT DAMPNESS

To save the original soles of shoes and protect the feet from dampness, a patch of fabric-rubber compound is being made. It comes in a long strip from which pieces may be cut as desired and attached with an adhesive. Electricians using it insulate their shoes, as it is a nonconductor.

Outfit for Saving the Original Soles of Shoes and Protecting the Feet from Dampness

CLOTHES WASHER IS CYLINDER THAT WILL FIT ANY TUB

Large metal hooks hold a cylindrical electrical washer in any tub while a motor-driven pump in the casing does the work.

Electric Washer that Fits Any Tub and Consists of a Centrifugal Pump to Circulate the Water

The motor shoots a stream of water against the sides of the tub which starts the clothes swirling. The water flows into the cylinder through small openings and is forced out by a four-blade centrifugal pump. It is especially designed for small apartments and may be used in a bathtub.

PENCIL TOILET KIT HAS ROUGE, POWDER AND PUFF

Hidden in the lower part of the barrel of a collapsible pencil is a tiny powder and rouge puff and space for storing a small amount of cosmetics. The section that holds the lead is screwed into place for writing and, when taken off, is connected to the barrel by a short chain. A slight pull on either end of the pencil exposes the powder and puff store. The entire outfit is folded up and carried in a small bag.

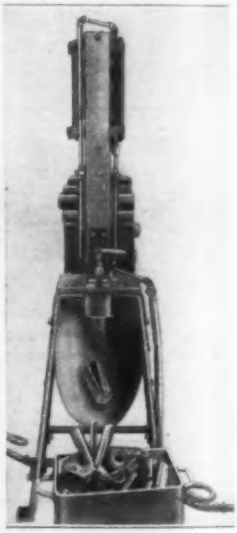
Pencil Barrel Open, Showing Rouge Stick and Puff; Slipping Pencil into Carrying Case

TOKYO BEGINS TO DIG SUBWAY TO COST FOUR MILLIONS

As part of the reconstruction plan for Tokyo, Japan, work has been begun on a mile and a half of subway. Plans were well under way for the Tokyo underground railway before the catastrophe, but that event, and the lack of funds, have reduced the project to one calculated to cost $4,000,000. The government believes that by the time the stretch of road is completed there will be an opportunity to lengthen it.

OLD DRY CELLS ARE STRIPPED FOR ZINC AND BRASS

By salvaging the zinc and brass in worn-out dry-battery cells with the aid of a machine operated by compressed air, the reclamation department of a large railroad system effects a considerable saving each year and prevents the accumulation of additional rubbish. The cells, fed into the hopper, are slit in half, the zinc and brass extracted, and the wax used for sealing purposes.



HELICOPTER UP EIGHT MINUTES FLIES FOUR THOUSAND FEET

What is said to be one of the longest flights ever made by a helicopter, a type of airplane that can make vertical ascents and descents, has been accomplished by Marquis Pescara, a Spanish aviator, who is reported to have flown a distance of nearly 4,000 feet and to have remained in the air eight minutes and thirteen seconds. This plane weighs nearly a ton and is said to have carrying power equal to that of a pursuit machine with a 180-horsepower motor.

DITCH DIGGER CUTS THROUGH PAVEMENT

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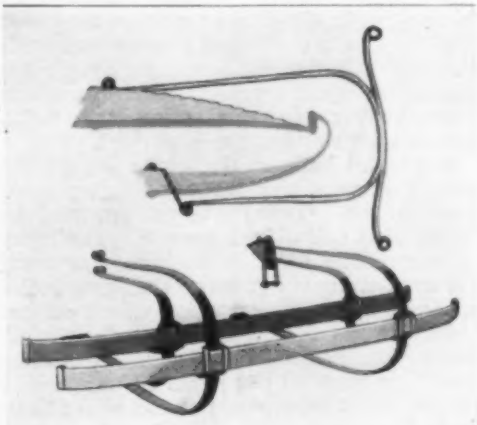
Wheel of Twenty Shovels on Powerful Ditch Digger Plowing through Pavement and Stone Below and Piling the Dirt on One Side as Caterpillar Tread Advances

Cutting through asphalt and a layer of stone to softer dirt below, a powerful motor ditch digger with an endless-chain arrangement of twenty sharp-toothed shovels attached to a huge wheel, effected a considerable saving in time and labor costs in digging a sewer in a Florida city. As the dirt and stone were brought to the surface in the large scoops, they were dumped on a belt conveyor and piled at the side of the trench. A caterpillar tread geared to the engine carried it ahead.

DOUBLE-BRACED AUTO BUMPERS HINGE ON AXLE AND FRAME

Attached to two spring loops hinged on the axle and frame of the car, an automobile bumper, recently patented, is said to distribute shocks in such a way that the possibility of damage is lessened. The double-brace arrangement also prevents buckling and bending, and there is no drilling or weakening of the frame in attaching it. Greater resistance and higher recoil also are said to result from the form of construction. The bumpers are constructed of stout, tempered steel and may be attached to any kind of car.



Front and Side Views of Double-Braced Automobile Bumper that Gives Extra Protection

¶Blowing red-hot rivets through a tube is displacing the old and dangerous method of throwing them from the forge to the workman on steel structures.

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How Science Has Aided National Game

Much of Improvement in Baseball Is Attributed to Evolution and Steady Progress of Mechanics and Invention

WHEN Babe Ruth hits three home runs in one game or the home team cracks out a barrage of base hits to score seven or eight times in one inning, it does not necessarily mean that long-distance hitting in modern baseball comes from superiority of today's players over those of years past. The truth is that much of the improvement in the game itself and in the proficiency of its players has come from evolution and progress in science and invention. Modern baseball efficiency is the outcome of two developments: One is changes in the playing rules of the game itself. The second is the scientific development and manufacture of the game's implements—the mechanical contrivances used, such as balls, bats, gloves, masks, shoes, spikes and practice devices.

Bats and balls in the olden days were cumbersome affairs, while gloves were not used at all. Today everything used in baseball is scientifically made. The most advanced and delicate machines are used, for everything is figured to the thousandth of an inch and the fraction of an ounce.

In various forms, baseball was played as early as 1839, but the real game—in even a similar form to the game of today—did not really come into vogue until about 1860, and it was not until 1871 that there was organized baseball. In those days there were .300 hitters—players who hit safely an average of nearly once in every three times at bat—but there were few restrictions to the game then. Bats of any size were used. Fouls did not count as strikes. Distances were different. In 1875 gloves came into being. A few years earlier restrictions were placed on the sizes of bats. In 1872 the ball was limited to from nine to nine and one-quarter inches in circumference and from five to five and one-quarter ounces in weight.

Complete records are not available prior to 1905, but in that year there were only ten players in the National league who hit .300 or over. Only 183 home runs were made. In the American league only three regulars hit better than .300. But, in 1920, the .300 hitters in the National totaled eighteen and in the American thirty-three. There were seven men in the National hitting ten or more home runs—where originally ten was a remarkable record. Eleven in the American hit ten or more homers. Then, in 1921, Babe Ruth alone hit fifty-four homers. In 1922 Hornsby hit forty-two and Williams thirty-nine. Forty-seven regulars in the National hit .300 or better and thirty-eight in the American. There were 1,054 homers—529 in the National and 525 in the American.

Indications are that the records will continue to change and that the change will come primarily through mechanics. Take the ball itself, for example. The processes of making it are closely guarded, but it is

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View Across Right-Field Bleachers at the Yankee Stadium in New York During the World's Series Last Year; Below, Babe Ruth Sliding Safely Across Plate

a work of finest mechanical craftsmanship. Years ago, it was composed of a piece of rubber wound with string. Later machinery gave definite size and shape to the rubber center, wound the string tighter and added a horsehide cover. Today the "lively ball" is credited with the increased hitting, and mechanical invention produced the lively ball.

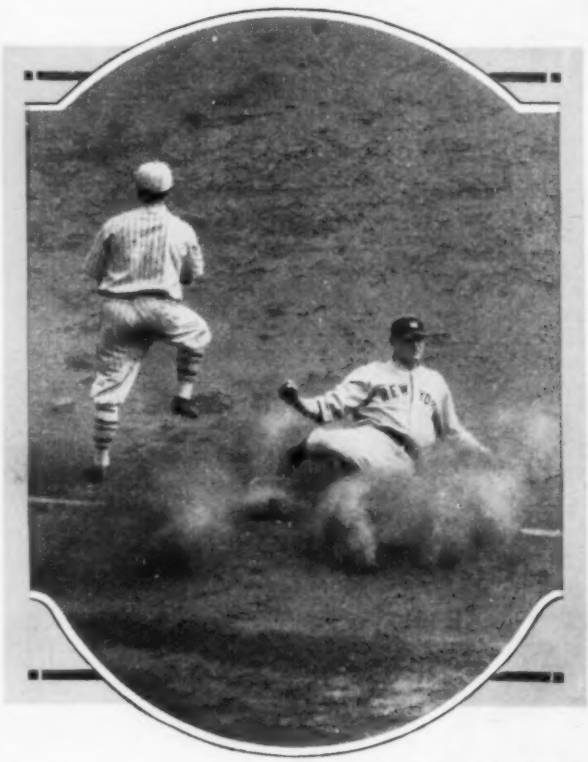
First, a piece of cork about three-eighths inch thick and fairly round is taken. It is chemically treated to give it extreme hardness and yet retain resiliency. Then, in molds, a rubber cover is made for the cork. This is one and one-quarter inches thick. It is constructed in halves and these are vulcanized together around the cork. The centers then are placed in a machine a dozen at a time. They are automatically turned, picking up the end of a fine linen string which is fed from balls. A thin layer of this is wound by the machine so tightly that it is as hard as rock. Then—automatically—the finest grade of imported wool yarn is attached. It is made in varied thicknesses—first thick, then thin, and so on. The change in the thickness gives tighter winding.

A few layers of this—and the yarn must be first mechanically tested so as to prove its strength—and then automatically another layer of linen thread is wound. Now comes the only real hand operation. The covers are sewed on by hand—but they have been mechanically cut out of horsehide by steel dies. Then a chemical preparation automatically tightens the cover, bleaches it and toughens it.

This is the process used in making the standard balls—Spalding and Reach. The cork center has given greater hitting distance. It has prevented lopsidedness in balls. The machines automatically make them to the exact weight and size specified.

In making bats machines have been developed which are almost human. First inspectors visit northern ash forests and select trees. They are cut into sticks forty-two inches long and four inches square. These are air dried a year and then inside dried for two weeks. A truck load is backed up to a specially built lathe which can be set to make any model bat—long, short, thick handle, thin handle, heavy at head or handle and so on. Every thirty seconds a man feeds a stick into the lathe. Every thirty seconds a complete bat of any size or model desired comes out the other side where it is automatically loaded onto another truck. For professionals, some bats are hand-turned, but they are few. The lathed bat—with a protruding axle at each end to hold it by—is then fed into an automatic smoother. As the bat is revolved, it pushes against sheets of mechanically revolving emery paper which smooth it off. Then a rubber with a specially made emery-paper glove gives it some hand touches and later it is mechanically oiled. The next machine chops off the axle ends of the bat and automatically carries these chips to the furnace. A machine stamps the name and model on the bat and it is ready to be packed for shipment. Sometimes it is specially colored first.

An error of a thousandth of an inch or a fraction of an ounce in the distribution of weight in a bat or ball will cause a professional to send it back, but machinery has



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Safe on Third! Yankee Player Sliding into Base After a Three-Bagger During the Last World's Series

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Some of the Sixty Thousand Fans Who Witnessed the Opening of the Last World's Series in the Yankee Stadium, One of the Greatest Structures Devoted to the Game

become so perfect that this seldom happens. Gloves are the development of scientific bats and balls which made hitting so hard that players had to have protection. Steel punches cut the gloves, machines sew them, mechanical cutters shape pads of felt for the interior. Original gloves were crude affairs with the padding just stuffed in anyhow. Now it is cut in layers, the thickness varying in spots to make a pocket for the ball.

Catchers' masks also have come through mechanics. The steel wire from which they are made is fed into a machine which —in the manner of a wash wringer—twists the wire to proper shape. Then it is electrically welded together and padded mechanically. Chest protectors are cut and stitched together by machines. Some are padded, but the best are rubber-lined and inflated with air.

Millions of people annually pay millions of dollars to see ball games, resulting in the erection of great stands such as the Yankee stadium in New York which seats over 60,000 persons. Here modern engineering, with all the mechanical inventions which accompany it, has come in.

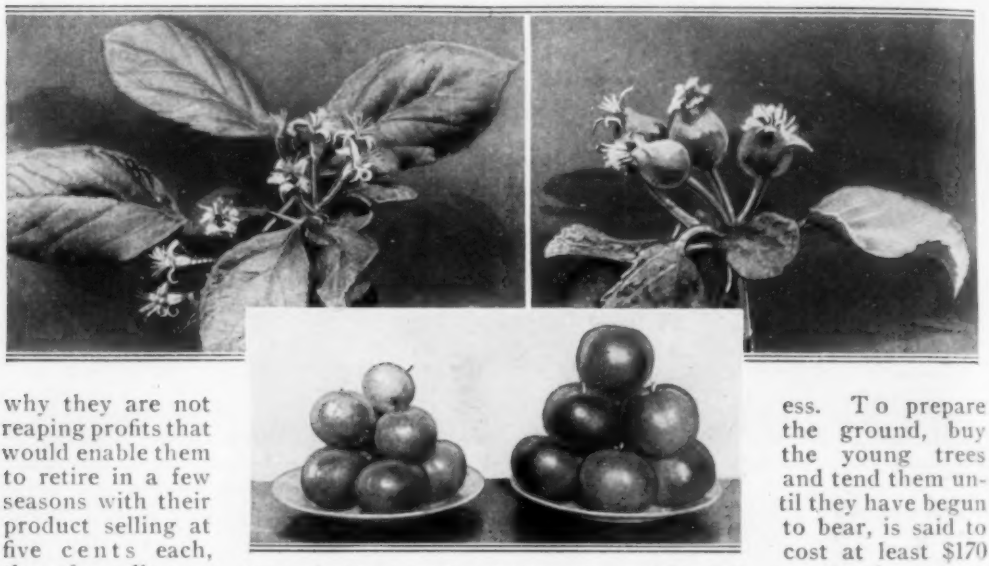
Automatic turnstiles to count the spectators, steel riveting, concrete and steel construction, surveying of the parks to regulate distances between bases to the fraction of an inch, scientific draining, the level, the transit, the concrete mixer, the electric welder, derricks, cranes, steam shovels and such inventions, are just a few of the things that have enabled baseball to become America's national game.

MACHINE-GUN BULLETS CLEAN BLOCKED CEMENT KILN

In the cleaning of cement kilns, a novel use has been found for machine guns. From the earliest period of the industry, manufacturers have encountered difficulties through the accumulation of cement in the making inside the kilns, necessitating the suspension of operation until the obstruction has been removed. Then the fires have to be drawn and the accumulation attacked with pokers until broken up. Recently, however, such a formation was attacked with a machine gun in a plant at Catskill, N. Y., and shot away. The weapon was operated so that the mass was cut down quickly without injury to the brick lining of the kiln.

WHY YOU PAY TEN CENTS APIECE FOR APPLES

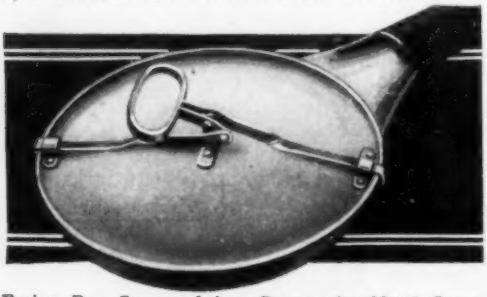
Money does not "grow on trees" for the apple raiser any more than it does for others, according to orchardists, who explain that their work requires expert attention, considerable investment of capital and a continual gamble with the forces of nature. It is largely this "manufacturing" process which explains, the growers say, why they are not reaping profits that would enable them to retire in a few seasons with their product selling at five cents each, three for a dime or at higher figures in the larger cities. One grower estimated his last year's crop cost him $1.20 a bushel. Prices at the time were ranging from $1.00 to $1.75 a bushel, wholesale. Spraying the trees from five to eight times each year must be done at a particular time of the season to insure the scale and scab-killing solutions doing their work. Thinning the fruit to give it better color and greater size, fertilizing and cultivating the soil, and finally, the important task of picking and marketing the apples are expensive steps in the "making" process. To prepare the ground, buy the young trees and tend them until they have begun to bear, is said to cost at least $170 an acre in a country where irrigation is not necessary. When all this work is done, the grower frequently finds that much less than half of his crop will command "Grade A" prices, the only profit-making rate.



Blossoms at Spraying Time (Left) and Too Far Advanced (Right); Fruit from Thinned and Unthinned Trees

COVER FOR FRYING PAN LOCKS ON SKILLET, SAVES HEAT

For converting a frying pan into a roaster, a metal cover has been invented by a Nebraska man that locks on the sides of the skillet. It is said that the lid greatly reduces the time required for cooking meats and improves the food flavor by retaining vapors which ordinarily escape. Grease is also prevented from flying onto the stove and, as heat is confined in the utensil, less fuel is needed. Easily fitted in place, or removed, the cover is claimed to be a valuable addition for campers' outfits, as with it roasting may be done on an open fire. Pressing the handle down fastens two sliding clamps to the vessel's rim; these are automatically released as the lid is lifted.



Frying Pan Converted into Roaster by Metal Cover that Locks on Sides of Skillet

¶ Brickmaking was one of man's earliest pursuits. Babylon was acquainted with the art, and it is recorded that the Israelites baked bricks from clay mixed with chopped straw.

TRACK CREEPING IS PREVENTED BY LINKING TIES TOGETHER

To prevent rails from creeping, U-shaped spikes that act as links to bind the ties together have been made. The usual tendency when the rail slips is to drag the joint ties ahead under the force of moving trains. This widens the spaces and weakens the track. By connecting the ties, the weight of additional ballast is utilized in keeping them from moving. The spikes are put in easily, do not project into the ballast to menace electric circuits, and require little maintenance expense after they are installed.

HORSES WORK WITHOUT DRIVER IN HAULING CONCRETE

In hauling concrete from the mixer to the point where it is needed in making pavement, the horses of a Chicago company have been trained to work without drivers. One man at the mixer turns them around and spots the carts under the

Driverless Horses which Have Been Trained to Carry Concrete Between the Mixer and the Dumps

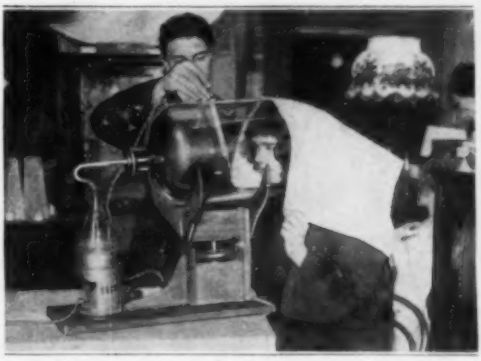
chute, another at the dump turns them around and trips the gate and a third, midway between the other two, keeps the horses moving. Once the animals are broken in, it is said that they rarely give any trouble.

LINERS START AROUND WORLD EVERY TWO WEEKS

Modern Magellans can start twice a month on the voyage that the early Portuguese navigator found so difficult and perilous, since one of the Pacific coast steamship companies has established an around-the-world service with fortnightly sailings. For this purpose a fleet of seven liners, built by the American government and leased from the shipping board, will be used. In rounding the globe the vessels will call at twenty-one ports in 112 days.

ELECTRIC STEAMER FOR FACE TO IMPROVE COMPLEXION

As an aid to the care of the complexion, an electric steaming apparatus has been invented for giving the face a "vapor bath."

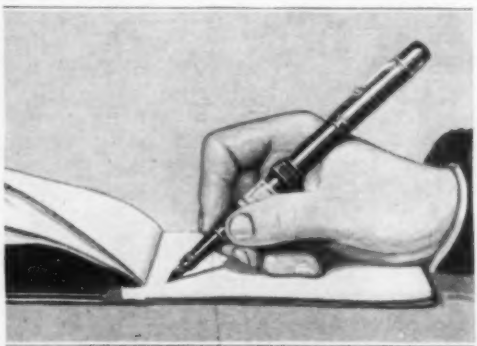


Giving the Face a Thorough "Vapor Bath" in Steamer; Generating Flask at Left

Steam quickly generated by electricity under a small flask, passes into a glass compartment, one end of which is large enough to permit the person taking the treatment to insert the head. An operator watches a thermometer and regulates the temperature and the quantity of hot vapor admitted to the chamber. Only a few moments are required, it is said, to give the face a beneficial steaming.

BAMBOO FOUNTAIN PEN'S POINT IS MADE OF GROOVED GLASS

With a barrel of bamboo, a fountain pen has been made with a grooved, glass point down which the ink from the reservoir flows. It may be used for ruling, duplicate



Self-Filling Bamboo Fountain Pen, the Point of which Is Made of Grooved Glass

and triplicate copying, as well as ordinary letter writing, and it is also self-filling.

Flaming Stream of Gas and Oil Bursting from the Sea, the Blaze Continuing for from Four Days to a Week Until Subterranean Reservoir Is Fully Drained

FLAMING OIL GUSHER AT SEA TURNS NIGHT INTO DAY

Passengers and crews of boats running between the island of Trinidad and the coast of Venezuela, in the gulf of Paria, report having seen the surface of the water illuminated for a great distance by a blazing column of gas and oil. It is explained by scientists that the Orinoco river carries into the gulf enormous quantities of silt and that this part of the coast is subject to earthquake shocks and also underlain with oil. A fissure developed in bedrock on the floor of the gulf will extend to an oil reservoir. The pressure is so great that the oil and gas, forcing their way upward and pushing along everything in the way, cause an island of silt to suddenly appear on the surface. Continued pressure beneath the island eventually causes it to burst like a bubble and free the accumulated oil and gas beneath, which immediately ignite and burn until the supply is exhausted, usually in from four days to a week. The gas has a rather low ignition temperature and heat developed by friction between it and the salt water is sufficient to ignite it.

FORTY-POUND CIGAR IS VALUED AT SEVENTY-FIVE DOLLARS

What is said to be one of the largest cigars ever made was shown at an eastern tobacco exposition. It was rolled from

Giant Cigar that Contains Enough Tobacco to Make Several Hundred Average-Sized Smokes

broadleaf tobacco from the Connecticut valley and is five feet in length. The value of the tobacco used is estimated at $75.

BEST WAY TO WORK TAUGHT WITH PICTURE CABINET

For illustrating to executives and foremen the most efficient methods of doing work of all kinds, a lantern cabinet has been devised that shows slides of industrial

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Inventor and the Cabinet He Has Devised for Exhibiting Efficiency Picture Shows

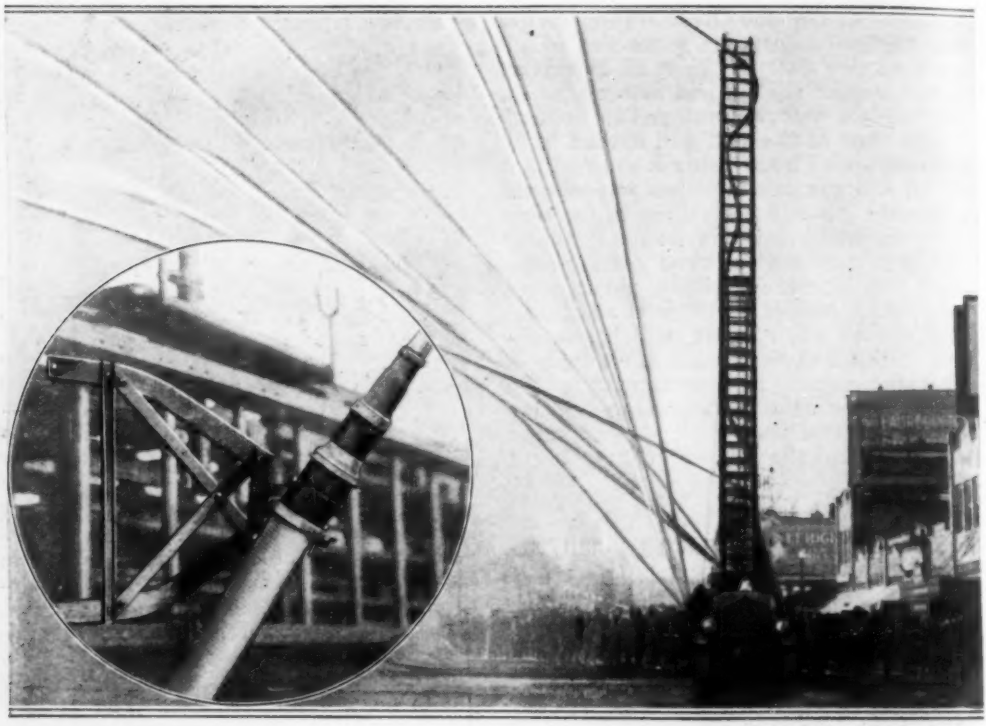
scenes. It is a combined stereopticon and stereoscope and, by its use, details of pictures may be studied at leisure and more closely than is possible with motion pictures or ordinary photographs. Figures stand out in natural perspective and are more clearly seen as the vision field is illuminated. The slides are automatically put in place before the eye. The cabinet has space for storing several hundred views, is easily carried about, and is simple to operate.

DOLLAR-AN-ACRE-A-YEAR LOSS BY EXPOSURE OF TOOLS

Leaving their tractors, harvesters or other machinery exposed to the weather or putting them in poorly constructed sheds, costs the nation's farmers approximately $370,000,000 every year through deterioration of equipment, according to recent estimates. Motoring through a section of Illinois, a party of engineers, in a distance of 126 miles, counted twelve tractors, each costing not less than $1,000 apiece, standing in the fields without any protection. The party estimated that the annual loss on all farm machinery by neglect of this sort amounted to about $650 per square mile for that territory or about one dollar an acre. On this basis, they figured the bill that the farmer pays for letting the weather damage his tools.

FIRE-NOZZLE HOLDER DOES WORK OF THREE MEN

Doing the work of three men in directing a high-pressure fire-hose nozzle, a holder has been invented and submitted to tests in Atlantic City. In an exhibition, twelve streams were driven with tremendous force over the beach to form a fire "curtain" without human aid except at the initial direction, thus releasing some thirty-six hosemen for other service. The streams were held in rigid position and carried a sufficient quantity of water to drown out any ordinary conflagration.



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Aiming Powerful Water Barrage without Aid of Firemen by Fixing Hose Nozzles to Holder Clamp, and Brace Attached to Ladder Rung

AIR AND OIL-RUN LOCOMOTIVE IS TESTED IN ITALY

Oil and air may replace coal and steam as motive power for Italian locomotives if the invention of an engineer of that country proves practical and is adopted by the government. He has devised an internal combustion engine that fits on the tender of the locomotive, uses a low grade of fuel oil, and runs an air compressor. The air is pumped into the boiler and is fed to the cylinders in place of steam. Freezing by expansion when the air is released has been avoided, it is claimed, by letting it first bubble through hot water heated from the exhaust of the engine. Saving in fuel, ease of operation, and a low installation cost are claimed for the system, which can be placed in any locomotive at little expense, it is said. When the train stops, the engine is shut off, thus effecting a further saving in fuel not possible with a steam locomotive.

FERN IS THE MOSQUITO'S FOE; RELENTLESS AS OIL

Growing so thickly on the surface of stagnant pools that mosquito larvae are unable to get air, a tiny fern has been developed that is expected to prove an effective ally to oil in the warfare against the pest. The plant multiplies rapidly, its leaves and fibers soon forming a network over the surface of the water like a smothering "blanket." The fern is expected to prove practical where the use of oil is objectionable or where supplies of it are difficult to obtain.

CONTROL OF HELIUM GAS KEPT AS A MILITARY SECRET

Enough helium gas is now available in the United States to keep filled and ready for service 200 airships of the size of the navy dirigible "Shenandoah," according to Dr. Richard B. Moore, former chief chemist of the bureau of mines. Laws for the conservation of the helium resources of the country will be introduced, it is expected, at this session of congress. The gas occurs principally as a constituent in the natural gas wells of Texas, and the problem is to separate it from the inflammable part of natural gas which may then be used for industrial purposes. Other important sources of helium are said to be known to the government, but their location and extent are being kept military secrets.

EGG BEATER CLAMPED TO BOWL PREVENTS SPLATTERING

By means of an egg-beating set consisting of a beater which may be clamped to either of two glass bowls, housewives are saved the annoyance of guarding against splatterings from the mixture being made and the strain of holding the ordinary device for long periods as is sometimes necessary. The instrument is quickly attached to the bowl by means of a small lever and the containers are of ample size. The extra jar may be used either as a cover

Egg Beater Clamped to Bowl and Extra Jar Tipped on Top as Mixer

for the beaten egg or for mixing additional materials which may be needed for a culinary task.

¶ Every hundred sets of automobile license plates in California weigh eighty pounds. As there are approximately 1,250,000 cars registered in that state, they carry a little more than 1,000,000 pounds of tin and steel in the plates.

GIANT CLAMS TRAP SEA DIVERS IN GRIP OF SHELLS

Shells of huge clams found off the coast of Papua often weigh more than 400 pounds. Divers who accidentally step into

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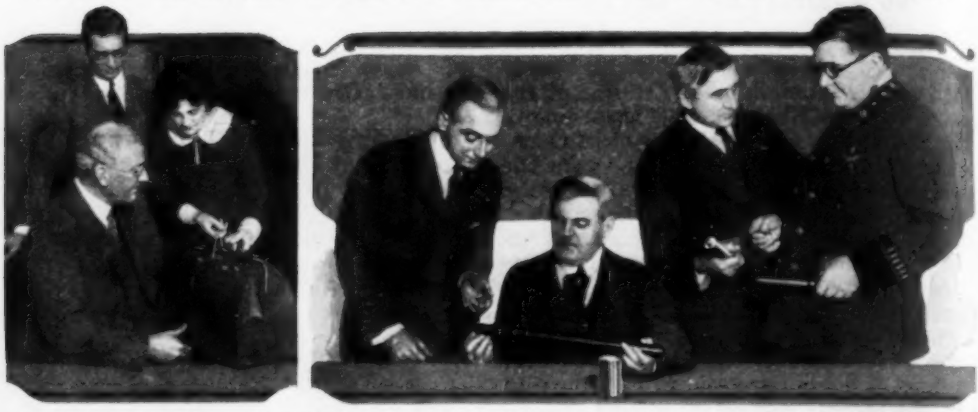
Giant Clam in Coral Reef Off New Guinea; Powerful Crushing Lips Partly Open

the open lips of the monsters are not infrequently held with such force that they cannot release themselves and are drowned. The shells close with such force that they serve as gigantic traps.

PARIS-TO-LONDON AIR TRIP IS CUT TO FOUR HOURS

Commercial aviation in Europe, where freight and passenger traffic by air is growing yearly, is now supplying a fast express service. In 1919, French companies carried only 960 passengers, but during the first ten months of 1923 the total was 14,671. The expansion of the freight business was even more pronounced. In 1919, approximately 30,580 pounds were carried, while in 1923, for the first ten months, the total was 127,570 pounds. From Paris to London by air in four hours, a saving of more than three hours over the combination boat and steamer routes, from Paris to Brussels in two and one-half hours, and to distant Morocco in only thirteen hours are common air schedules.

TEAR GAS IN POLICE CLUBS TO FOIL BANDITS

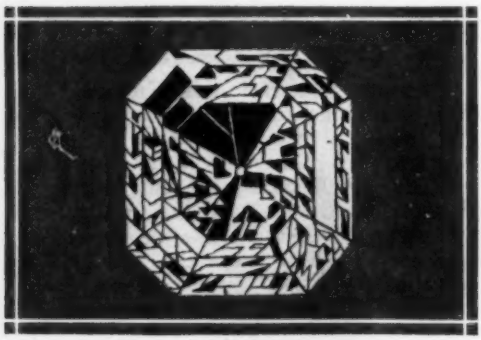


Satchel with Brass Eyelets through which Tear Gas Is Released When the Bag Is Snatched from the Carrier's Fingers and Policemen's Clubs Holding Cylinders of the Gas

To enable the police to deal effectively with mobs and bandits without the use of bullets, an inventor has filled maces and billies with tear gas. A bomb also has been patented that can be discharged by a foot control under the desk in a cashier's cage. This is for use in banks, theater box offices and elevated-station ticket offices. A bandit-proof bank messenger's bag contains a brass tube filled with the chemical. Two nickel rings attached to short, light chains run from the inside and are hooked in the fingers of the messenger. An attempt to snatch the satchel, or the mere dropping of it, serves to discharge the gas through brass outlets. It is said to be impossible to remain within ten feet of the bag when the gas is turned loose.

BIGGEST DIAMONDS OF HISTORY ARE HIDDEN FROM SIGHT

Weighing 127 carats, what is said to be the world's largest blue diamond has been offered for sale for $300,000 by an American firm. Appearance of the gem, larger than the Koh-i-noor, of England, in a public market, emphasized the fact that most of the large diamonds of history are now seldom seen, but are hoarded among the prized crown jewels of European monarchies. The Great Mogul, believed to have been found in the Golconda mines, has disappeared. The Orloff, stolen by a French soldier from the eye of an idol in an Indian temple, was found among the Russian crown jewels. The Braganza, owned by the King of Portugal and reputed to be valued at $1,000,000, is never displayed except to a favored few. In 1905, all previous records for large diamonds were broken with the discovery of the Cullinan in the Transvaal. It weighed one and one-third pounds and was given to King Edward VII. Much of the glitter of the diamonds of antiquity, experts say, is fictional. If some of them were subjected to tests now performed every day on simple solitaires for an engagement ring, their value could be written in much smaller figures. Weight, quality, perfection of color and cutting are now accurately determined and appraised under market conditions that have become largely standardized.



Sketch of Facets and Proportions of Large Blue Diamond to Show Its Size

¶Only four gaps, with a total of about twenty-five miles, remain to be closed in order to have an interconnected electrical power system from British Columbia to Mexico, a distance of about 1,400 miles, according to a report of the Federal Power commission.

From Millstones to Skyscrapers

Granite First Used to Grind Flour and Grain Is Now the Center of Great Industry in Vermont

NEARLY a century and a half ago someone discovered that the granite from the Vermont hills made the hardest and best millstones for grinding wheat into flour. These stones were carted by ox teams for miles and shaped for the purpose.

Drill at Work on Narrow Ledge in Granite Quarry

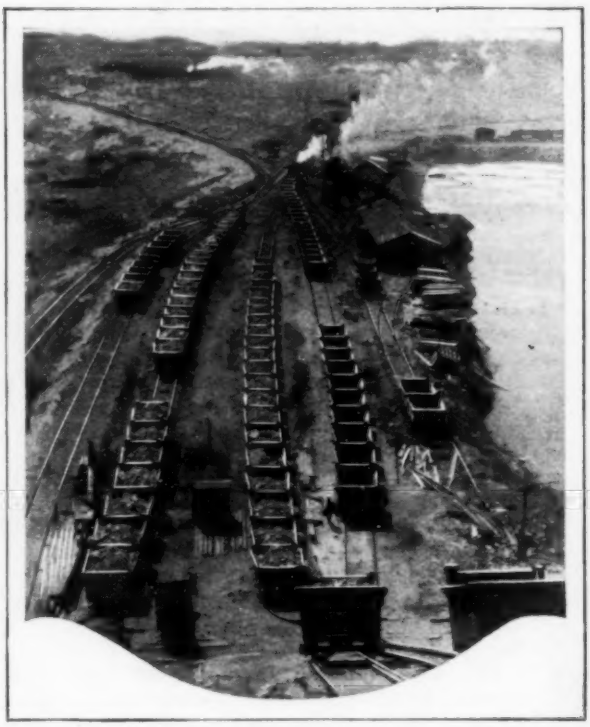
This dates back as far as 1781. In 1788 the first settlement was made, and the town which is now Barre was organized in 1793. It was chartered as Wildersburg, but this name became unpopular, because, as the ancient record says: "The name has ever sounded uncouthly and is disagreeable on account of its length." At the town meeting called to choose a name, the principal contest being between the names Holden and Barre, it was decided to settle the dispute by a boxing contest between the two champions. Adjournment was taken to a neighboring barn, where the Barre champion won.

In 1872 the first granite shed was opened in Barre, but it is only within comparatively recent years that the industry has become so widely known. At the present time Vermont produces nearly half of the monumental stone used in the United States, including marble. The total capital invested in the industry in the Barre district alone is upward of $10,000,000. There are about 200 cutting sheds and when working to capacity they employ about 5,000 cutters, polishers, tool sharpeners and lumpers. For the year round the average payroll is $2,500,000 and the average daily wage about eight dollars. Some of the expert carvers demand from twelve to twenty dollars per day.

During the past forty years Barre has grown from a country village to a thriving city, which is the center of the monumental granite business of the world. There are about sixty quarries, owned by about a dozen firms, and the total average output of those on the old "Millstone Hill" is nearly 1,500,000 feet. This is valued at upward of $5,000,000. Of this amount about 200,000 cubic feet are shipped out in the rough, to be finished in retail monumental yards scattered over the country.

What is said to be the steepest steam railroad east of the Rockies—the Barre railroad—serves to reach the quarries, winding about the hill in a picturesque manner to a total elevation of 1,025 feet.

Channels Cut with Air Drills in Side of Cliff



Long Lines of Dump Cars that Clear Away Debris from Quarry So that Larger Slabs May Easily Be Moved

While the highway from the city to the quarries is only four miles long, the railroad through its switch-backs and sidings, is over forty miles long. Ten empty flat cars make a load going up and seventeen loaded cars is the average coming down. Ten thousand carloads of rough stone are brought down every year, a total weight of over 500,000,000 pounds. The area of Barre granite extends over a strip of land about five miles long by three wide, but a portion only about two miles square is all that has so far been developed. There seems to be no limit to the dimensions of blocks that can be quarried. The largest piece ever moved, though not taken out of the quarry, or moved very far within it, was detached from a mass and measured 200 feet in length, eighty feet in width and twenty-four feet thick. It weighed approximately 69,120,000 pounds, and contained over 384,000 cubic feet. This block, when cut to proper sizes, filled 1,728 flat cars, allowing 40,000 pounds to the car and at present prices was worth over $500,000. In addition to the most modern equipment, the district is known for the skill of its workers in executing the finest carvings. Most of them come from northern Italy, where they served in the marble industry. The latest type of granite shed is a straight, rectangular barnlike structure, with traveling crane, which serves every part of the inclosure. These are rapidly replacing the old-style circular shed, with the mast of a derrick in the center of the yard.

Preparing Heavy Charge of Explosive, Which Is Fired by Electric Current

HEART TISSUE IS STILL ALIVE AFTER TWELVE YEARS

Preserved in a fluid that supplies food for its cells, a piece of chicken's heart has been kept beating for twelve years by Dr. Alexis Carrel in his laboratory at the Johns Hopkins university. The fragment's twelfth anniversary in its "new life" occurred last January. The tissue was transferred directly from the beating heart of the fowl to the fluid. From time to time, the liquid has to be changed and all waste materials that have accumulated removed.

JADE BUYERS' VOICELESS BIDS TOLD BY HAND CLASPS

By secret hand clasps with the auctioneer, native purchasers attending the annual auction of jade quarried during the year in Burma, communicate to him the prices they wish to pay for the various pieces. The day before the auction, the stones, each bearing a numbered card and cut so the interiors can be seen, are exhibited to the prospective buyers. As the auctioneer calls off the numbers, the buyers rush up to him and, grasping his hands and wrists, which are hidden under the long white sleeves of his garment, tell by grips the price they are willing to bid.

FOLDING KITCHEN TABLE FITS INTO ALMOST ANY SPACE

For kitchen tasks that can be done as well while sitting down as standing up, a small, drop-leaf table has been manufactured to lighten the housewife's labors and to fill many needs. It is sufficiently large to form a breakfast table but, when both sides are down, is narrow enough to be stored in a small closet or pantry and takes up but little room if stood against the wall.

Kitchen Table of Correct Height to Provide Rest for Work while Sitting Down

SCALES ON TWO-WHEEL TRUCK GIVE ACCURATE WEIGHTS

Easily moved and always available when wanted, a combination truck and portable weighing machine has been made to enable the user to accurately weigh whatever he buys or sells at the time of the transaction. The scales are fitted under the two-wheeled, hand truck and have a capacity of one ton. They are adaptable, however, to any system of weights and measures.

Combination Hand Truck and Scales to Eliminate Disputes over Exact Weights

GELATIN'S FOOD VALUE SHOWN BY BABY CLINIC TESTS

That gelatin is of much greater importance as food than is generally realized is said to have been proved by tests conducted at the University of Pittsburgh. A report on experiments made with albino rats said that animals that had grown at only one-half the normal rate were brought to full weight by the addition of gelatin to their diet. It also was asserted that tests at baby clinics have shown remarkable results from the use of the product in infant feeding and malnutrition. The greatest benefits derived from the use of gelatin, according to the report, come when it is combined with other foods, such as cereals, bread, milk, eggs and ice cream.

¶To find the parasite of the Japanese beetle, a recent importation that has been very destructive in this country, entomologists of the department of agriculture are making a search in Japan.

KEGS SPRAYED WITH PARAFFIN CONSERVE FOOD PRODUCTS

Notwithstanding the popularity of the tin can, glass bottle, steel barrel and fiber container, much of the nation's food is still transported, at least part of the way, in wooden pails or kegs. So great is the consumption of lumber for this purpose that the government has inaugurated means of conservation. One effort along this line is the paraffining of the interior surfaces of kegs, which not only preserves the wood and makes their repeated use possible, but assists in keeping the food products. Melted paraffin is kept hot in a double-jacketed kettle by mean of steam from an automatic gas-fired boiler. There is a vertical nozzle in the center of the kettle which is placed in the bunghole of the keg. Live steam then carries a mist of hot paraffin to all parts of the interior.

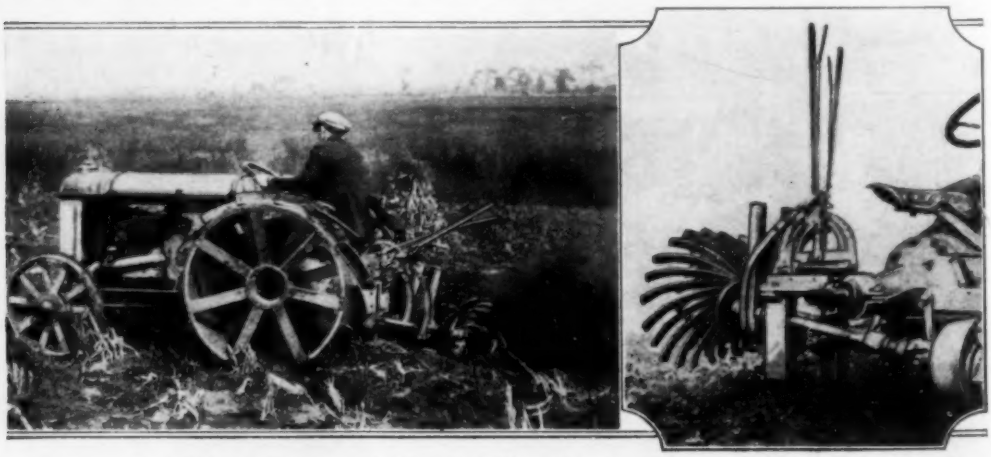
Paraffining Interior of Keg to Make Possible Its Repeated Use as a Food Container

SQUARE COINS TO REPLACE ROUND

Square-shaped halfpenny pieces are being minted in Australia to replace round ones. They pack more securely in boxes for shipping and, in cutting them from the large metal sheets, less material is left over than with those of the usual shape so that smaller quantities of metal have to be sent back for remelting. Corners are left rounded so they will not tear the clothing.

PLOW LIKE SHIP'S PROPELLER CUTS FARM COSTS

Plowing and pulverizing the soil are done in one operation by a rotary attachment for a tractor invented by a western ranchman. Two "rosettes," each fitted with twenty stout steel blades, are so adjusted that they cut into the earth with little difficulty and the whirling action "beats" the clods into fine texture, leaving the soil ready for the drill or planter. The blades chop up cornstalks, weeds and other refuse, preparing a strip fourteen inches wide without leaving a furrow. The inventor claims the device saves half the labor in preparing the ground for seeding, as it does the work of plow, pulverizer, harrow and drag. Tests are said to have shown that it requires about the same amount of power as an ordinary plow.



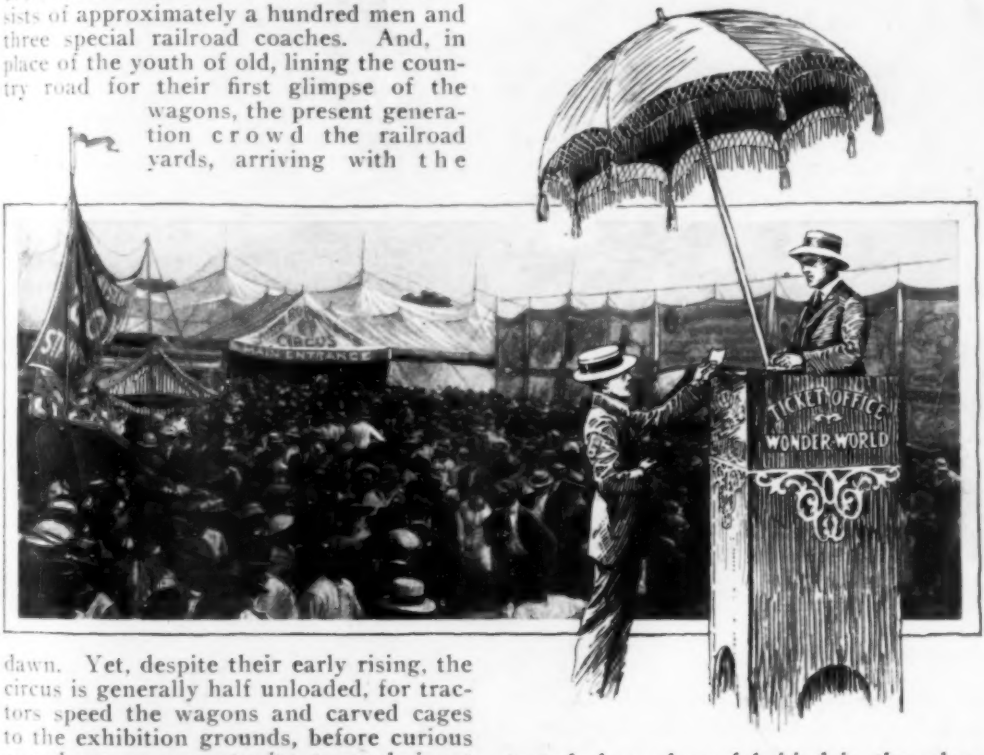
Preparing a Corn Field for Planting with "Propeller" Plow; Rotating Blades, Detailed at Right, Cut up the Stalks, Pulverize and Harrow the Soil in One Operation

Behind the "Big Top" of the Modern Circus

Canvas "Hogs" and Stake Drivers Are Replaced by Gasoline Motors, and Flares by Electricity

FROM five horse-drawn wagons trailing along the highway, just a little more than a hundred years ago, the circus of today has developed into one of the mechanical marvels of modern civilization.

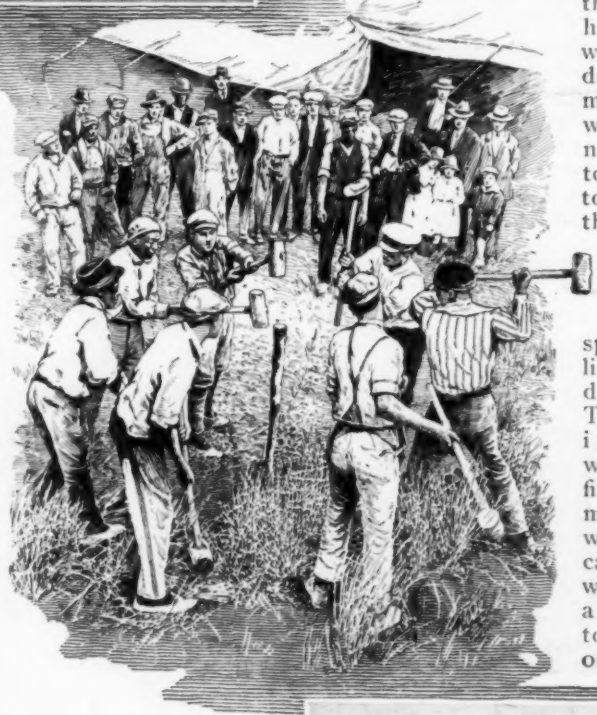
In the early days it was simply a case of driving each night to the next exhibition point. Ahead of the show traveled a man in a buggy who posted small advertisements about the countryside. Now, however, the modern circus advance crew consists of approximately a hundred men and three special railroad coaches. And, in place of the youth of old, lining the country road for their first glimpse of the wagons, the present generation crowd the railroad yards, arriving with the dawn. Yet, despite their early rising, the circus is generally half unloaded, for tractors speed the wagons and carved cages to the exhibition grounds, before curious eyes have an opportunity to peek in at the barred windows.

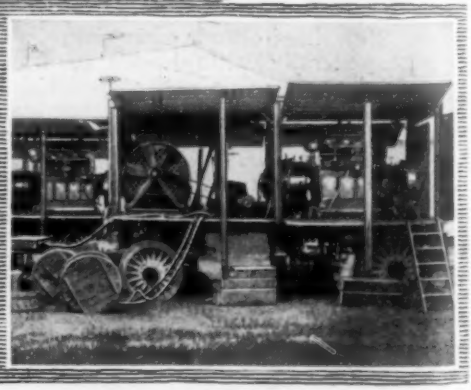


The strides between the original circus and the modern one have been tremendous. Fifty and sixty years ago, yes, even five years ago, when the small boy arose early, he did so with the correct idea that he would be put to work either watering the elephants, or helping erect the tents, and, for his services, see the wonder gratis. His efforts were welcome. He was, in fact, depended upon to help get the tents in the air. Today mechanical labor-saving appliances have banished, forever, this opportunity. All the work is done by machinery. Probably the first great advance in the circus world was made when the wagons were abandoned and railroads substituted as a means of transportation. Today the circus travels some 12,500 miles during its 175 days' season, or half way around the world. More recent developments came during the last five years. Before that time the tented shows lagged behind in the adoption of labor-saving devices. There would always be plenty of cheap labor to erect the "big tops" argued the owners. Then came the war. For the first time, it became hard to obtain men, and engineers and inventors were called in to design labor-saving mechanical devices. Thus today, instead of the gangs of sledge-hammer equipped men, singing and driving the "big-top" stakes, there is only a miniature pile driver, the put-put of a gasoline engine replacing the tap of the sledges. The whole is built compactly on a sturdy

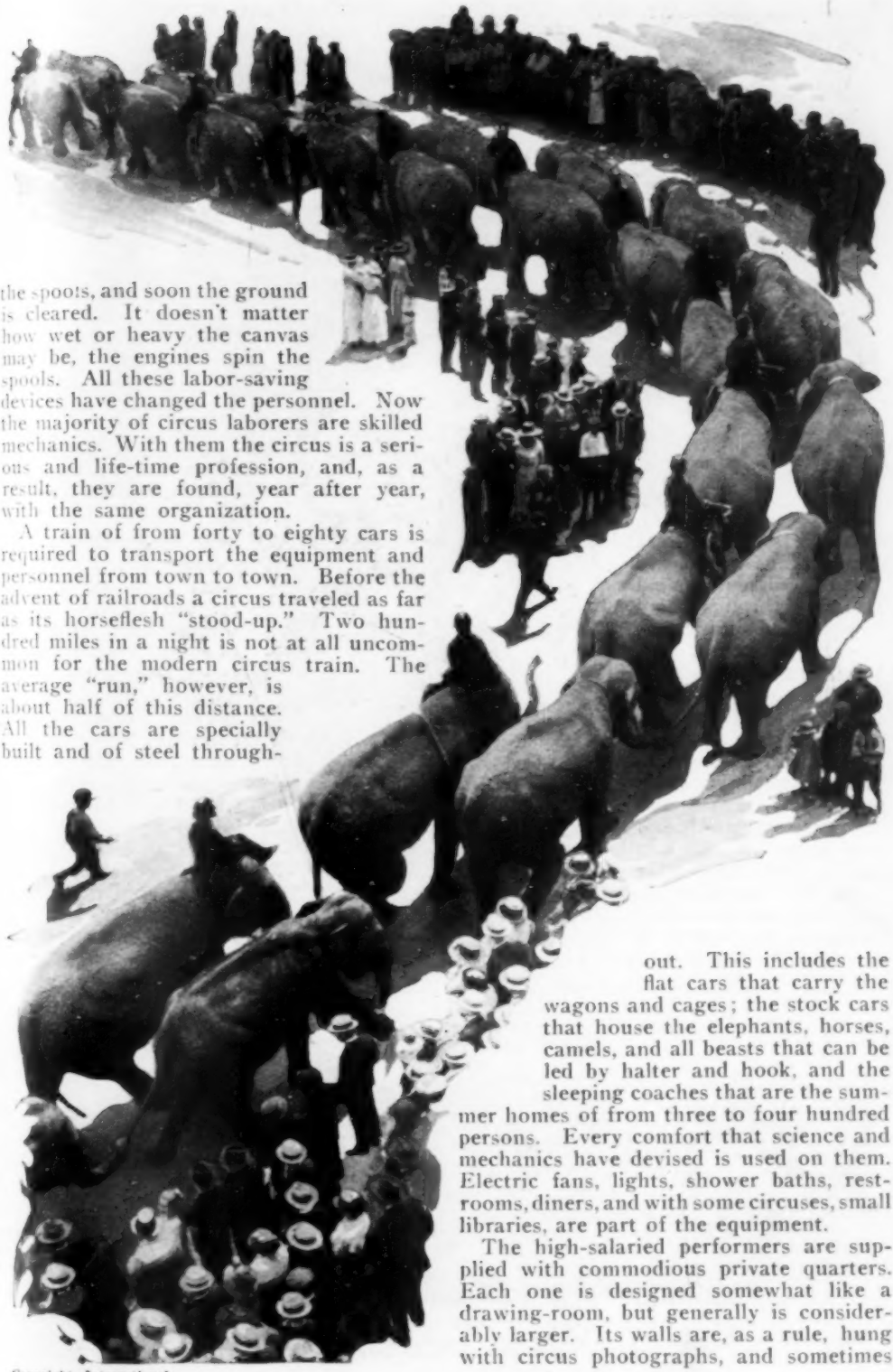
wagon, and pulled by a team of horses. Where formerly a gang of ten men, at the best, could only drive a stake in a minute and a half, this machine puts down three a minute. And it is the same with all modern circus equipment. When the heavy wagons roll from their places on the flat cars, specially built tractors pick up strings of from three to six and make off for the circus grounds. The baggage horses, used only for parade purposes, are having their breakfast, instead of, as of yore, hauling wagons in teams of from six to twenty. The same occurrence happens at night. Five or six tractors easily replace a hundred head of horses, and do the work many times more speedily. Then, the cook-house, too, has resorted to mechanics. It makes far more speed, and prepares more appetizing meals. On one wagon is a donkey-engine boiler, in front of which are generally several massive soup kettles. The wagon is placed when the circus arrives, and the boiler fired up. It furnishes steam to run dish-washing machines, steam-tables, the soup kettles, and the massive coffee urns. In supplying light for the tanbark rings, electricity has replaced gasoline flares, the system used being a marvel of compactness and efficiency. Massive dynamos, run by gasoline engines, are carried on wagons of extra strength. These generators easily supply sufficient current to light a small-sized town. Two such plants are carried. One is idle, but in readiness, in case the other fails. The current is carried in rubber-encased wires, laid on the surface of the ground. When the light plants are moved, the sides are simply fastened up, and the tractors haul them away.

The massive spreads of canvas that compose the huge tents are wound on motor-driven spools mounted on wagons. At night, after the tops are lowered to the ground, the different sections are unlaced, and the spool-wagons, with their sputtering gasoline engines, driven in place. There is no rolling, or lifting, with the aid of fifty or sixty men, the dead weight of the canvas into a wagon. Instead a rope is fastened to each section of canvas, and to





Stake-Driving Machine (Top) Contrasted with Old Hand Method (Center), and a Portable Electric-Lighting Plant



the spoots, and soon the ground is cleared. It doesn't matter how wet or heavy the canvas may be, the engines spin the spools. All these labor-saving devices have changed the personnel. Now the majority of circus laborers are skilled mechanics. With them the circus is a serious and life-time profession, and, as a result, they are found, year after year, with the same organization.

A train of from forty to eighty cars is required to transport the equipment and personnel from town to town. Before the advent of railroads a circus traveled as far as its horseflesh "stood-up." Two hundred miles in a night is not at all uncommon for the modern circus train. The average "run," however, is about half of this distance. All the cars are specially built and of steel throughout. This includes the flat cars that carry the wagons and cages; the stock cars that house the elephants, horses, camels, and all beasts that can be led by halter and hook, and the sleeping coaches that are the summer homes of from three to four hundred persons. Every comfort that science and mechanics have devised is used on them. Electric fans, lights, shower baths, rest-rooms, diners, and with some circuses, small libraries, are part of the equipment.

The high-salaried performers are supplied with commodious private quarters. Each one is designed somewhat like a drawing-room, but generally is considerably larger. Its walls are, as a rule, hung with circus photographs, and sometimes

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even oils, for a great many circus people are art connoisseurs, and collect paintings and prints. Two dining cars are always carried. One for the workingmen, and the other for the more accomplished. In the performer's dining car—which the workmen are not allowed to enter—there is table and counter service. Meals can be had at any time during the night or day. This car serves as a club-room and rendezvous after the night performance. Before the advent of railroads, circus people, no matter what their rank, piled on top of the loaded wagons, or drove in buggies from town to town. During the night, and trusting to the faithful horses to find the road, they snatched what sleep they could. It is no wonder that, with this tradition still in the mind, the circus life is thought a hard one. The contrary, however, is true, due to the comforts provided by the advancement in science and mechanics.

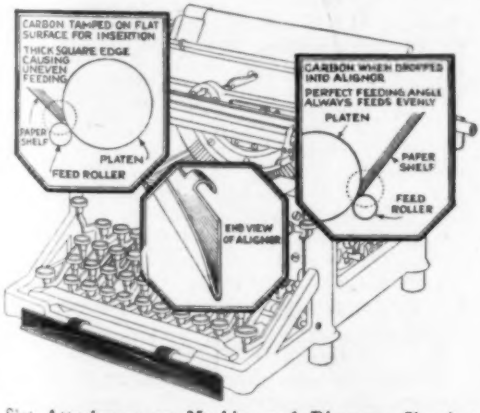
Elephant Being Given Its Morning Shower Bath; Equestrienne on Favorite Mount, and Spool on Which the "Big Top" Is Wound for Transportation on Flat Cars

WOLVES BEING KILLED SO FAST EXTERMINATION IS SEEN

Prairie dogs have been exterminated over wide areas, and the large wolves are being so reduced in numbers that over most, if not all, of the west their end is definitely in sight. More than 4,900 wolves have been killed in the last year, according to government figures. In 1923 the money spent for the destruction of predatory animals on state and private lands totaled $276,890, while $163,000 was expended for rodent control. An idea of the extent of the work carried on may be gained from the fact that an intensive campaign instituted to eliminate the coyote was pursued over an area of more than 200,000 square miles. It is estimated that no less than 75,000 of these pests were slain as a result of poisoning operations during the year.

LINE UP TYPEWRITER CARBONS WITH SLOT ON MACHINE

In typing carbon copies, the stenographer is assisted in the arrangement of the sheets so that they will slip into the rollers easily and in alinement by a slot-like attachment fitted to the front of the machine. By tamping the carbons in this curved groove, the edges of the papers are moved to an angle so that they are inserted with little friction or binding. The device eliminates



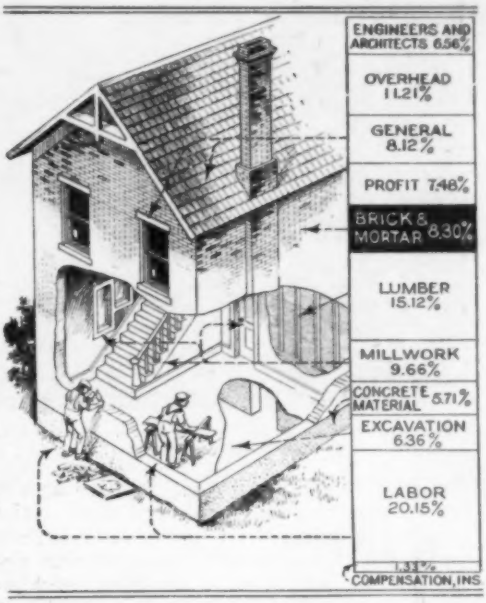
Slot Attachment on Machine and Diagrams Showing Difference Caused in Position of Sheets

any need of straightening the sheets after they are in the machine, and insures more legible copies to the carbons.

Oyster culture represents the most valuable fishery in the United States, the yield in 1920 being valued at $15,000,000.

COST OF BRICK IS SMALL PART OF BUILDING EXPENSE

Analysis of the cost of buildings shows that frequently brick itself represents only 8.3 per cent of the total expense when



Tabulation of Costs of Materials and Kinds of Work in Constructing a Brick Building

overhead, profits and engineers' fees are included, and 11.25 per cent when only materials and labor are used as the basis for figuring. These percentages will vary in different localities but, according to a large appraisal company, they represent typical costs. Under modern conditions, the labor bill approximates 27.5 per cent of the total expense when work and materials only are figured, millwork 13.2 per cent, and lumber 20.5 per cent. When the value of the furniture or the stock is added to other costs, the expense of the brick in the "all brick" structure is negligible.

MONKEY'S BITES TEST MONEY

Owing to the spread of counterfeit coins in Siam, monkeys are being employed in the banks to test the spurious currency, it is reported. Installed behind the counters, the monkeys test the coins between their teeth. If good, no marks are left on the metal, and the coins are thrown into a box at the animal's side. Should the coins be bad, the metal bears visible marks and is thrown on the floor, later to be swept up and destroyed.

BRAKES ON RAIL-COACH DOORS HELP PREVENT ACCIDENTS

To prevent slamming, brakes have been fitted on the sliding doors of the suburban

Releasing Door Brakes by Turning Handle to One Side to Permit Easy Entrance

cars on a western railway. By turning the top of the handle in either direction the brakes are released when the door is shut and it slides back easily. The device decreases the likelihood of accidents and injuries to the fingers, holds the door securely in place, eliminates unnecessary noise, and saves the glass.

LAUNDRY BAG EASILY EMPTIED BY SLIDE RING IN BOTTOM

Pulling a slide ring at the bottom of a laundry bag allows all the contents to fall into a tub or basket. The top is completely sewed over an ordinary coat hanger with the hook protruding through an eyelet so that the bag may be hung up and held at its full width at all times. An opening near the top eliminates the necessity of pulling apart a gathering string when filling.

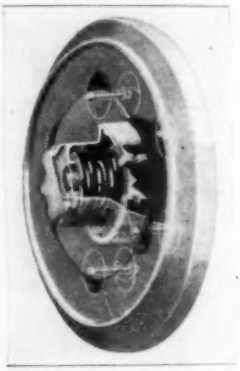
Laundry Bag Fitted to Coat Hanger: Diagram Illustrating Method of Filling and Emptying

TREE ANTS ENSLAVE SPIDERS TO SPIN WEBS FOR THEM

Green tree ants, which make slaves of a certain variety of spiders and force them to spin webs with which leaves are bound together for their nests, are said to have been found in Queensland. On a recent trip through the region, Capt. G. H. Wilkins, of the British museum, collected some of this species to make further study of their habits.

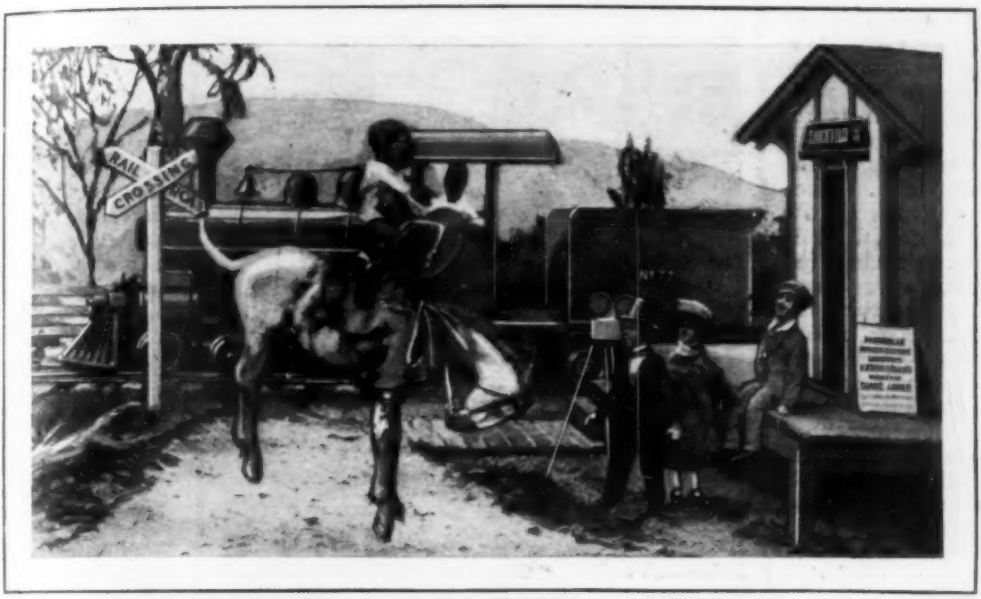
AUTO WHEEL ABSORBS SHOCKS AND CUTS UPKEEP COST

Through the application of a principle of indirect suspension for the axle and every ounce of weight it carries, a wheel for automobile vehicles has been patented which absorbs shocks and smooths out the roughest roads. While it is structurally devoid of any resiliency whatever, it provides a resilient bearing at the hub that is said to eliminate unsprung weight. A tremendous increase in tire mileage, a decrease in upkeep costs, longer life and greater endurance are said to be some of the advantages gained by the use of the wheels either on cars or trucks.



HANDLING OF RADIUM IS FOUND TO CHANGE BLOOD PRESSURE

Workers who handle radium in the United States bureau of standards and in other places where it is prepared for medical and scientific use frequently suffer low blood pressure, as a result of the radiations that permeate the skin and tissues. An eighteen months' study of the physical effects upon the workers has resulted in recommendations that such employes work only five days each week, take at least thirty days' vacation each year in two-week periods at six-month intervals.



Rubber "Actors" Lend Realism to Movies

Comic, Educational and Scientific Pictures Are Worked Out on Miniature Stage with Animated Figures

BY means of a series of ingenious inventions and most painstaking study of anatomy and sculpture, a Los Angeles producer has created a type of animated miniature figures which opens up most interesting fields in the realm of educational and scientific motion pictures.

As in the case of the use of all miniature figures, the process of making motion pictures of this inventor's figures is a laborious one, each exposure on the film necessitating a re-posing of the "actors." In producing 500 feet as much as four months is required to set up the various scenes and make the hundreds of poses. The work is not unlike that of the maker of animated cartoons who has to make a new sketch for each exposure in the film.

The special features which characterize Mr. Roop's work in this line and which overcome the serious limitations which have existed heretofore, include the use of a special rubber composition, with a flexible steel framework or skeleton. The figures are first made in clay and from them molds are made, from which in turn are cast the final products, equipped with the steel skeletons. This composition will hold its shape indefinitely and yet is sufficiently pliable and rubberlike to permit the "director" to give the figure any desired pose. The skeletons, being approximately correct from an anatomical point of view, the various poses of the human and animal figures become extraordinarily lifelike. Heretofore the use of miniatures has been confined to a few attempts at employing dolls. Lacking flexibility and the ability to be molded, the movements are stiff and their range of action marked by very decided limitations. On the other hand, the new miniatures walk with an amazing naturalness, lifting their feet from the ground in a manner which contrasts markedly with the "drag" of animated dolls. The advantages of the flexible manikins and animals go even farther, marked changes in facial expressions being possible. A jungle lion actually acts out his roar with a mouth that opens wider and wider, while his eyes bulge fiercely and his mane stands erect. The changing facial

expression is made even more natural by the use of movable eyes, a feature on which a patent has been sought. The eyes used are of glass and are set in sockets in such a way that by inserting a pencil or other instrument in the hole corresponding to the pupil, their position can be changed as desired. Movable lids are provided also, which add to the realistic effect. In conjunction with the use of these figures is the special stage. It is equipped with numerous overhead wires running in various directions. The figures of the actors are suspended from these in most instances by invisible threads. This rather complicated overhead construction is invaluable to proper spacing of moving figures, thus assuring the accurate register of the actor's motions.

The accompanying photographs illustrate, in part, the wonderful possibilities which these figures offer in producing comics. There is a realism about actual photos of these skillfully designed figures and the stage furnished with the minutest care, which heightens the enjoyment for both juvenile and adult spectators. But while comics offer an important and alluring field for use of these lifelike miniatures, there is an equally attractive field in teaching natural history. As these figures are designed to be anatomically correct, the creator being an experienced hunter as well as sculptor, it is possible to plan actions and show scenes in jungles and wildernesses which could not be produced from real life without the expenditure of hundred of times the amount involved in these productions, while caged or trained wild animals could not be made to do the things these miniatures do, under any circumstances, presenting scenes which the simplest child can comprehend.

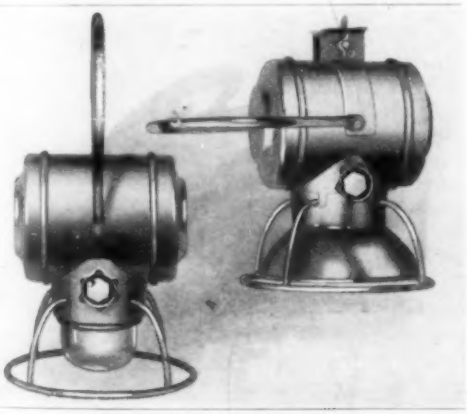
Moving Models of Rubber and Steel on Miniature Stage

ELECTRIC-OPERATED CUPS OIL AUTO AT TOUCH OF BUTTON

Oiling an automobile chassis at the touch of a button on the instrument board is possible with cups that contain a small piston, or ejector, worked by current from the battery. A measured quantity of oil is forced into the spring shackles and bearings every time the button is pressed. About sixty charges of oil, sufficient for 5,000 miles of travel, are contained in each cup. Only a single wire is used to connect them with the switch.

INSTANT LIGHT, RED OR WHITE, GIVEN BY SAFETY LANTERN

Giving either red or white light at the touch of a button, a safety electric lantern has been invented that will burn for seventy-five hours. A red sleeve covers the two bulbs with which it is equipped, so that the color of the rays may be instantly changed. There also is a bracket attachment and a reflector for use when a wall lamp or a searchlight is needed. The light is focused in any position by turning the handle, thus aiding in making emergency automobile repairs at night. Life of the batteries is prolonged by the double bulbs, which may be used separately or together. The lantern weighs less than three pounds



Adjustable Electric Lantern Used as a Danger Signal, Bracket Lamp or Searchlight

and is said to be valuable in railroad work or in places where there is danger of fire.

¶Fabrics woven from a mixture of silk and thistle down are well known in China. The mixture is so carefully compounded that often even experts are deceived by the finished product.

SPRAYS OF WATER IN WASHER CLEAN DISHES QUICKLY

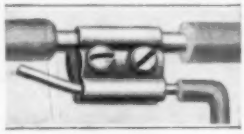
Swirling jets of hot water forcibly striking from various angles in a barrel-shaped

Tray of Dishes Thoroughly Washed in Machine: Inset Illustrates Action of the Water

washer, cleanse and rinse soiled dishes thoroughly in a few moments and leave no stains or marks. Soap is supplied from a special container when the hose is attached to the faucet. The washer has no moving parts and is portable. Its height makes stooping or bending unnecessary. Constructed of durable materials, it is designed to operate efficiently from the flow of an ordinary kitchen faucet. Because of the constant current of hot water, it is self-cleaning, thus eliminating further unpleasant work when the dishes are done.

SOLDERLESS LINK FOR WIRES IS LOCKED WITH NUT

Eliminating all the labor of soldering, a connection is being made for electrical wires that locks in place with a nut and bolt. It is made of brass and is curved so that the sides act as a spring, firmly clamping the wires. Neither vibration nor pulling can loosen it once in position, it is said. The device is specially for automobile mechanics and telephone linemen.



ELECTRIC RANGE LIKE CABINET COOKS FOR WHOLE FAMILY

Suitable for baking, roasting, broiling, boiling and all kinds of ordinary cooking, a compact electric range, designed especially for apartments and cottages where space is limited, has been placed on the market. It is heated on all four sides at once by current from the ordinary lighting circuit and is so heavily insulated with soapstone that it acts as a fireless cooker, completing baking and roasting operations after the electricity has been disconnected. An aluminum grid which sets on top, a broiler and oven heated by separate plugs, may be operated together or separately and all cooking for an average family is quickly and thoroughly done. The stove takes up but little room and is large enough to roast a 15-pound turkey.

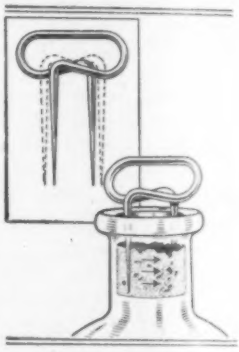
Compact Electric Cabinet Cooker that Roasts and Boils, Opened to Show Compartments

SNAILS YIELD GLUE FOR CHINA

Natural glue, or snail adhesive, is being used by an English expert in the repair of valuable antique china. The substance is found secreted at the extremity of the bodies of many of the larger specimens of common garden snail. It is preserved in airtight phials, or the snails may be kept in captivity and the glue used while fresh.

CORK PULLER HAS TWO PRONGS AND ACTS LIKE PINCHERS

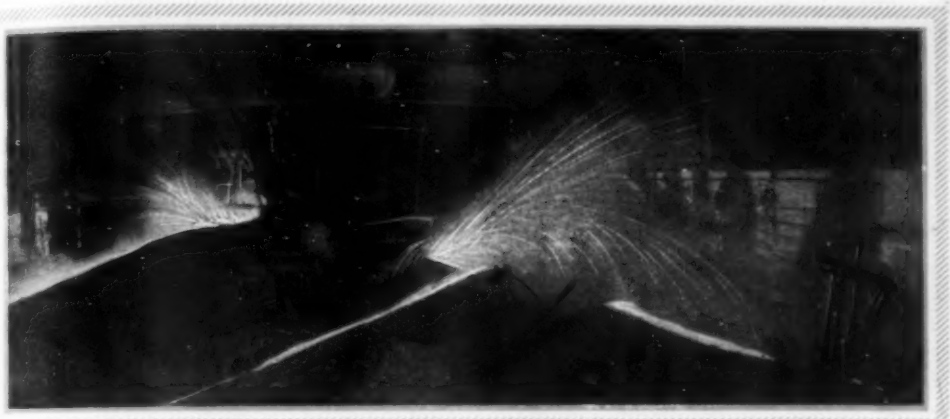
Corks are removed easily from bottles of different sizes with a cork puller fashioned from a short length of steel wire. The ends are tapered into sharp points and the wire is twisted to form a convenient handle for turning. By bending the prongs in or out, they are made to fit large or small corks and are so sharp that they slip in easily and there is little danger of pushing the stopper inside the bottle. Additional grip is obtained when the sides of the handle are pinched together like a pair of tongs.



CIGARETTES MADE WITH TUBE SET IN POUCH

Cigarettes may be made even in a gale of wind by anyone with a pouch with a sliding tube that fills without waste the papers wrapped around it. The tobacco is tightly packed by a plunger. A side pocket is provided to hold the papers. Lined with rubber, the pouch also may be used to fill a pipe in the ordinary way.

Forming a Cigarette with the Sliding Tube Set into a Tobacco Pouch which Also May Be Used in the Ordinary Way to Fill a Pipe



Molten Slag Flushed from the Cinder Notch of Blast Furnace

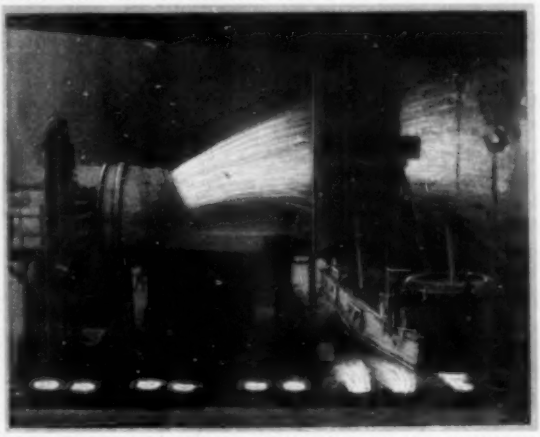
Steel Master Points Out Road to Success

"There Is Little that the Human Mind Can Conceive that Is Not Possible of Accomplishment," Declares Charles M. Schwab

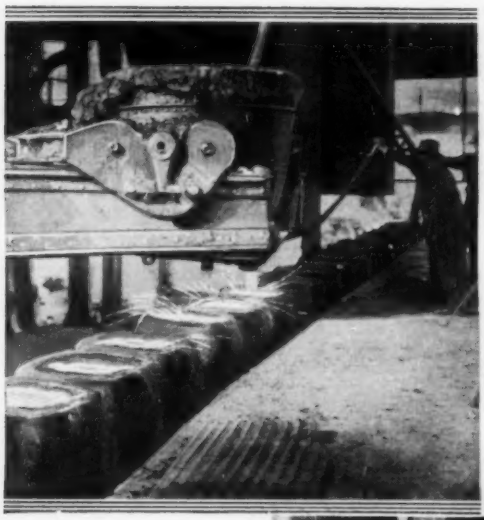
By CHARLES M. SCHWAB

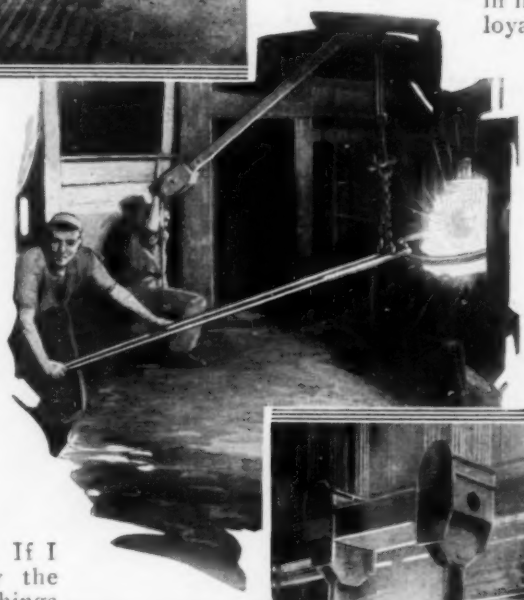
MY idea of the successful life is the man who has accomplished the objects for which he set out, doing something that is worthy of a real American man.

Money is often a matter of chance or good fortune, and is not the mark of a successful life. It is not the thing that brings a throb of pleasure or a thrill into my life. And I would not pose as a successful man if that were to be the measure. But when I look about me and see the multitude of friends that I have after forty years of business association with men, when I see the great lines of smoking stacks and blazing furnaces that have come into being because of my interests and activity in life, and when I see a work that I set out to do successfully accomplished and meeting the approval of my fellow men, then a real thrill comes into my heart and I feel that I have done something worth while. The captains of industry do not keep on working for the sake of making money, but for the love of completing a job successfully. One of the dearest friends that I ever had in life, Andrew Carnegie, used to say to me when I went to him with my balance sheet and showed him how many hundred thousand dollars we had made that month or year, "That's interesting, but show me your cost sheet." That is the mark of successful manufacturing, how economically and how well you do a thing, not how much money you make in the doing of it. So his mark—and he was a wise man—his mark of successful industry is my mark of a successful life. Set out with some definite purpose in life and accomplish that purpose. There is little that the human mind



Bessemer Converter Ejecting Millions of Red and White Sparks and Flames of Violet, Orange and Blue



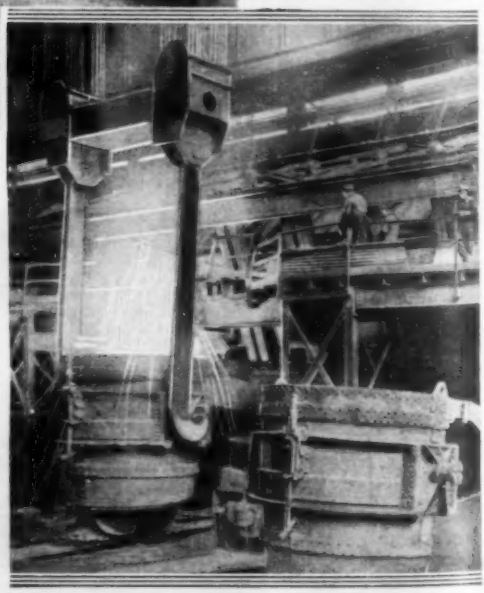


can conceive that is not possible of accomplishment. The thing to do is to make up your mind what you are going to drive for, and let nothing stand in the way of its ultimate accomplishment. Now, in my long experience in business life and association with men, there are some fundamental things that must not be overlooked. If I were asked to say the most important things that lead to a successful life, I should say that, first of all, was integrity—unimpeachable integrity. No man can ever do anything of any great value in life, and have the confidence and approval of his fellow men or be successful in his undertakings with other business men, if he doesn't have the reputation of being a man of honor and integrity.

When I first entered the business world in 1879, the United States was producing only one million tons of steel a year; now we produce fifty million. Never was the opportunity and the reward so great as it now is. The hardest struggle of all is to be something different from what the average man is. I don't believe in "super-men," for the world is full of capable men, but it's the fellow with determination that wins out. Bet on the United States if you must bet at all, for any good enterprise in this country is worth more than six or seven per cent. Put your all into any business which depends for its success on your own brains and determination to win. Be not fearful in borrowing money; I have borrowed more money than any other man in the United States and on less collateral.

Any man who goes into anything in life and does it better than the average will have a successful life. If he does it worse than the average his life will not be successful. And no business can exist in which success cannot be won on that basis.

Another important thing is loyalty. What measure of success I may have won in life I attribute to the loyalty I had for a dear old friend who was my first steel master, Captain Bill Jones. He was a great mechanic, just a natural genius at mechanical things. No education at all. He knew nothing of engineering or chemistry or the sciences. Now, having been



Molten Metal Flowing into Ingot Mold (Top); Puddler Removing Pasty Ball of Iron from Furnace (Center), and Open Hearth Pouring into Ladle

thrown in, fortunately, with him, I made up my mind that I could be very useful to that man by learning things that he could not learn, and above all, by being loyal to him and never letting the world know that the things for which he received credit were not his own creation.

The man that will selfishly stand alone and proclaim that he is the man who has done these things never is the man who really did them. My own experience is that there is no real effort in life that is not done better under encouragement and approval of our fellow men. A man goes along then with greater confidence. Marshal Foch, the great commander, once said to me: "This great military staff is like an orchestra, and each one fills his place. Each is equally important in the functioning of the whole. If the baton is in my hands it is merely a matter of chance, but we shall see to it that each man in this staff gets recognition for that which is due." You never heard a great man say, "I did this," or I will do that." In the management of my great enterprise I have yet to find fault with any man. If a man is such that you must find fault with him to get the best out of him, he is not a man to be desired in an organization. Show me the man that will do his best under approval, and I will show you the man that has within him the elements for successful going ahead.

There are other things in life than mere work. I believe an appreciation of the finer things in life, the learning to know the beauties of literature and art and music, will help any man in his career. A man to carry on a successful business must have imagination. He must see things as in a vision, a dream of the whole thing. A man can cultivate this faculty only by an appreciation of the finer things in life.

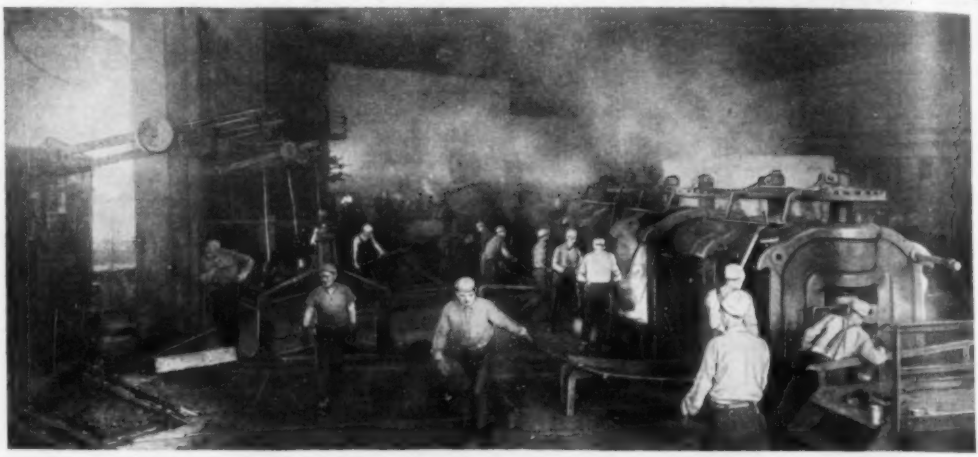
Courtesy, Iron Trade Review

Bloom of Glowing Metal Being Fed into Puddling Rolls Used in Converting It into Rails

Another great point is to concentrate and think upon the problem in mind until a satisfactory conclusion is reached, and then finally go ahead. If you have made a mistake, all right. Never find fault with a man because he has made a mistake. It is only a fool that makes the same mistake the second time. I tell a story of my own experience with Mr. Carnegie, as showing what this might mean.

As chief engineer of the works, I had just built a converting mill. I went to him and said to him: "If you will give me the money to build this mill I can save 50 cents a ton." Of course, he provided the money, and the mill was built. He came out to see it. I walked around with him. He saw the look of disappointment in my face and said: "Charlie, there is something wrong here. What is it?" I said: "It is exactly what I told you, and it is better than I told you. We save more than I said. But I don't mind saying that if I had to do the whole thing over again I would do it so and so. I made a mistake in that particular." He said: "Can you change it?" I said: "No." He said: "What does it mean?" I said: "It means tearing it down and doing it over again." He said: "Go ahead and do it. Don't make the same mistake a second time." Do you suppose, if he had been a fault-finding man, I ever would have told him? Not at all. He brought out the best in me. When that mill was torn down and a second took its place it was as great a success over the first as the first had been over the old one.

In our works at Bethlehem and San Francisco, and all over the United States, I adopted this system: I pay the managers practically no salary. I make them partners in the business, only I don't let them share in the efforts of any other man. For



Hot Mill Crews Roughing Down the Bars of Metal

example, if a man is manager of a blast-furnace department he makes a profit out of the successful conduct of his department, but I don't allow him to share in the prosperity of some other able man in some other department of the establishment. I give him a percentage of what he saves or makes in the department immediately under his own control and management. For example, if it takes a dollar a ton to make pig iron, and it takes him a dollar a ton to make pig iron, I say to him: "Well, you are no better than the average manager the country over; therefore you are entitled to only the usual wages. But if you can make pig iron at ninety cents a ton you are entitled to share with me in a large part of the profits. And if you make it for forty cents or fifty cents a ton you share to a very large degree." Therefore, I don't care how much a man earns. The more he earns the better I like him. And I pay in what I call bonuses to the various superintendents and managers of the different establishments more money for their successful management than I pay the stockholders in dividends. The worst thing that can happen to a man is to start life with influence. He has got to do twice as well as the fellow that starts upon his own merits, because, after all, it depends on the general opinion of all those around you as to how competent and successful you are, and when everybody says that you do well because of the influence back of you, then you have got to do twice as well as otherwise. Opportunities must come naturally, and the only way that they can come naturally is to give your whole heart to what you undertake.

CHARLES M. SCHWAB

BORN in 1862, as a boy, Mr. Schwab drove a stage near his home in Pennsylvania.

Then he entered a steel mill as a stake-driver in the engineering corps.

At the age of twenty-five years, he became superintendent of the Homestead Steel Works.

His ability brought him rapid promotion and he was made president of the Carnegie Steel Company and later head of the United States Steel Corporation.

When he resigned in 1903, he turned his attention to shipbuilding and obtained control of the Bethlehem Steel Corporation.

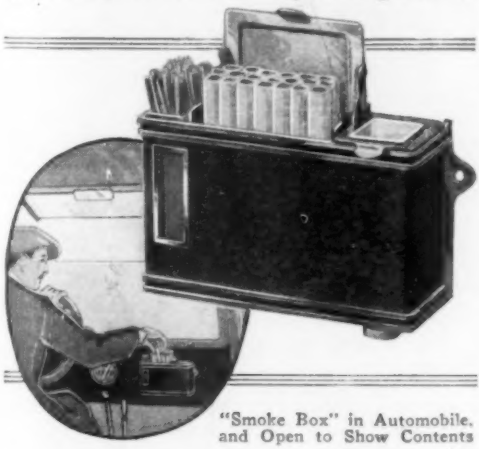
During the war he was director-general of the shipbuilding board of the Emergency Fleet Corporation.

FARM FOR MOOSE IN ALASKA TO PREVENT EXTINCTION

An attempt to prevent the extinction of moose whose numbers are rapidly decreasing, due to the ravages of rabbits that eat the birch bark on which the larger animals feed and to the activities of hunters, is being made by starting a moose farm near Anchorage, Alaska. It has been discovered that the animals thrive on hay, grain and grazing grass, and it is believed that they can be given regulation cattle feed in case the natural supply is depleted.

CIGARETTE HOLDER HAS SPACE FOR ASHES AND MATCHES

For home and office use and for the convenience of the motorist, an attractive holder with spaces for a package of cigarettes, a box of matches and an ash receptacle is being made. When the lid is raised, the "smokes" are lifted up within easy reach. The striking surface of the original match box is exposed through a slot in the side of the compartment. A notch on top of the case holds the lighted cigar or cigarette directly over the ash holder which may be removed and emptied by turning a small knob. For attachment inside the automobile, lugs are provided to screw to the instrument board. This style also has space for a mileage and gasoline



"Smoke Box" in Automobile, and Open to Show Contents

record book. The cases are made of polished metal and are covered with leather.

¶Consumption of electricity has practically trebled in the United States since 1912, according to a government report. In 1922, 45,307,536,711 kilowatt-hours were used as compared to 17,621,808,893 kilowatt-hours in 1912.

OXYGEN MASK TO AID AVIATORS SEEKING ALTITUDE RECORDS

To aid aviators in altitude flights six and seven miles above the earth's surface,

Copyright, Keystone View Co.

Oxygen Apparatus Designed to Aid Aviators in Altitude Flights Miles above the Earth's Surface

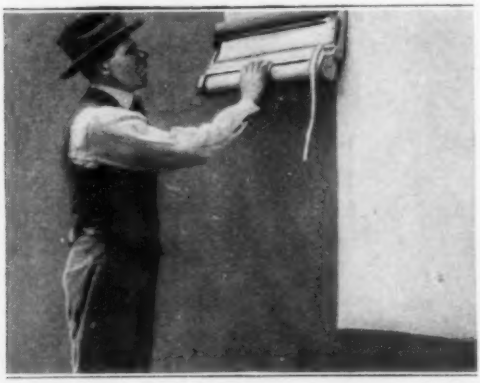
an oxygen mask has been devised to combat the rarefied air found at such heights. The usual method has been to carry a tank of oxygen in the plane, the pilot drawing it from a tube held in his mouth. Several years ago this method resulted in an almost fatal accident, the aviator losing consciousness when the tube accidentally dropped. But, after falling more than five miles, he partially recovered.

WATER IS SOFTENED FOR HOME BY PASSING THROUGH TANK

For softening water for household use a tank is being made that is connected directly to the supply line in such a way that the liquid passes through a mineral bed under pressure and thence direct to the faucets. Its use is advised in localities where the water is of ten grains or more hardness. In the kitchen, soft water is best for drinking and for other purposes. It requires less time to bake and cook fruits and vegetables, and helps retain the natural flavor. It also helps in washing dishes, keeps the hands soft and saves soap. With it in the laundry, strong cleaning compounds are not needed.

WALLPAPER LAID STRAIGHT WITH ROLLER HANGER

To aid in hanging wallpaper, a machine has been designed that lays the material

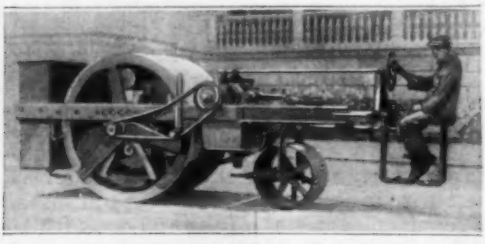


Roller Hanger that Saves Time and Paste and Enables Wallpaper to Be Laid Straight

on the surface directly from the roll, which can be fastened into the frame. It is said to save much time, as the paste is first applied to the wall instead of to the paper, and the sheet can be hung straight with less difficulty than where the old method is used. Light in weight, the device can be manipulated with one hand, leaving the other free to assist in smoothing the paper. It has a grip that can be held firmly, so any degree of pressure necessary may be put upon it. Great decrease in labor requirements and prevention of waste due to tearing of wallpaper on the pasting board are claimed for the apparatus.

GAS ENGINE IN ROAD ROLLER GIVES BETTER BALANCE

Slung inside the large roller of a road grader, the gas engine that propels it is protected from the weather, is easy to reach, and gives better balance, and its

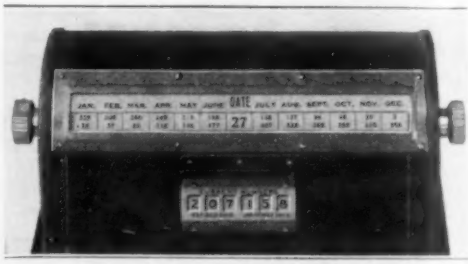


Powerful Road Roller Run by Gas Engine Slung Inside Crushing Wheel

weight is applied where it will be of the most use. Fuel is carried in a storage tank at the front. The roller is easily guided by a smaller rear wheel steered from the driver's seat. It has a speed of five or six miles an hour in forward or reverse, and is fourteen feet long and four and a half feet wide. Engine and steering gear are easily managed by one man, the task of stoking is eliminated, and in residence districts, persons are spared the unpleasantness of breathing clouds of smoke made by the ordinary steam roller.

TURN OF KNOB TELLS INTEREST DUE AT A GLANCE

To compute accurately and quickly the amount of interest due on loans, a convenient registering device, which shows at a glance the exact number of days between any two dates, has been adapted to use in banks and financial offices. Revolving cylinders, turned by knobs at the sides, show in large figures the number of expired and unexpired days between the time of the loan and its maturity, and register them on an indicator in front. Only a few twists of the fingers are needed to set the cyl-



Interest Register that Shows Days Between Dates and Amounts Due by Turning Knobs

inders, thus saving time usually required in searching through printed interest tables. The instrument also reduces errors.

MILLIONS OF MILES OF TWINE TIE ANNUAL WHEAT CROP

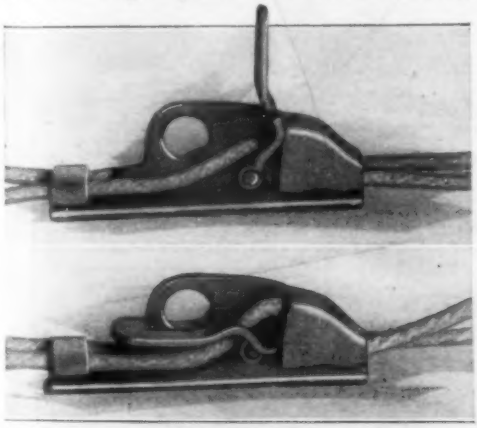
To tie the bundles of an average wheat crop in Canada, it takes approximately 100,000,000 pounds of binder twine, according to recent estimates and nearly 150,000,000 pounds were required for the 1923 crop. At the standard weight of the material, this would make a single cord more than 142,000,000 miles long. Most of the supply is imported from the United States and Great Britain, the value of the amount from the former country being nearly $5,000,000 for the fiscal year ending with March 31, 1923.

OUTSIDE ADVICE REDUCES COST OF HUGE SKYSCRAPER

By gathering the suggestions of a number of men trained in the management of office-building properties, owners of a 32-story skyscraper in Chicago are reported to have saved $250,000 in construction costs and added many desirable features to the structure. After the architect's plans were pronounced "100 per cent perfect" and all details had been checked many times, the rentable area of the huge structure was increased and other improvements made through submitting the blueprints to a conference of those who had actual knowledge of the perplexities of managing modern offices to get the best results.

CORD FASTENER FOR MAIL BAGS HAS NEVER-SLIP GRIP

To prevent the slippage of cords about mail bags, a fastener has been designed, by a postoffice employe, that operates with a lever. The clamp is simple in operation and does not injure the cords, an important consideration when it is known that the postal service uses about ten million mail bags a year and that the cord to



Mail-Bag Fastener that Clamps Cords Securely at Touch of Lever without Injuring Them

bind them up is an important item of annual expense. A cash award of $500 was given to the inventor.

WHY CIRCUS USES GRAY HORSES

Horses used in equestrian acts by circuses are nearly always white or gray—so that the spectators cannot see the powdered resin on their backs, put there to keep the performers from slipping.

HIGHWAY FENCE OF WIRE LINKS TO PREVENT ACCIDENTS

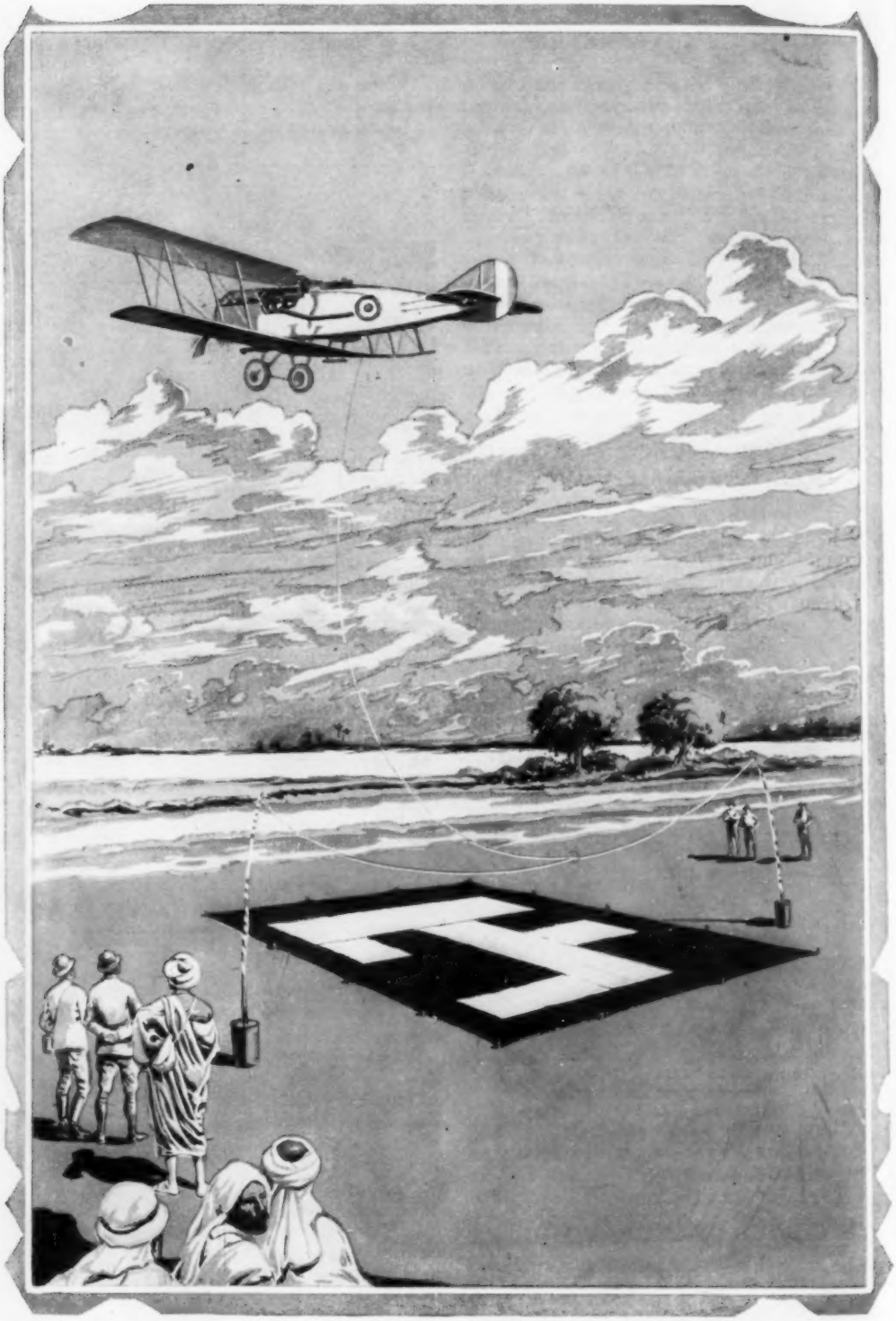
Wire net strung between posts to form a guard at dangerous curves in highways, is being tested by engineers in attempts to

White Wire-Fence Guard at Dangerous Curve to Protect Motorists and Their Cars

solve the problem of adequate protection for motorists. A fast-moving car would, on impact with the wooden rails now used, plunge on through or come to a dead stop. In either case the car would be wrecked and the occupants frequently injured. The wire netting is said to be so strong that automobiles cannot break through it and the interlocking meshes form a spring screen that eases the shock of a collision and brings the car to an easier stop. The wire is galvanized to prevent rust and is painted white to make it visible at night.

GUARD ON PARING-KNIFE BLADE PROTECTS THE FINGERS

Fitted with a saddle-shaped guard to prevent the finger from slipping out of place, and to give a better grip on the handle, a safety paring knife has been designed. The protector is fixed firmly at the base of the blade and is shaped to fit the curve of the finger in cutting. It is rounded so that blisters and callouses are prevented, and the front end of it is turned up to keep the finger from slipping off. With this attached, the sharp side of the knife is always easily identified and danger of cutting the hands is eliminated.



Picking Up Mails During Flight; a British Airplane in Mesopotamia Catching by Means of a Hook a Message Attached to a Line Suspended from Two Poles

MAIL PICKED UP IN FLIGHT BY HOOK FROM PLANE

Mail is being picked up by British airplanes during flight in Mesopotamia. The pilot's attention is attracted by a signaling device used during the war and consisting of pieces of cloth spread on the ground and moved in shutter fashion. The message is attached to a line tied to the tops of two poles about six feet high. The observer picks up the line by means of a hook dangled from the craft and the message is delivered as directed.

CLOTHING OF OLD NEWSPAPERS PRIZED BY CHINESE

Old newspapers skillfully cut and assembled into wearing apparel serve many natives of China as protection against cold. Since the effects of frost do not penetrate the material easily, it is said that such coverings, when worn next to the body, guard the owner from sudden chills. Preference is given to news-sheets with a good finish and thousands of tons of cast-off newspapers are shipped into the country each year for this purpose.

SOLDIER BUILDS MODEL AUTO DURING HIS SPARE TIME

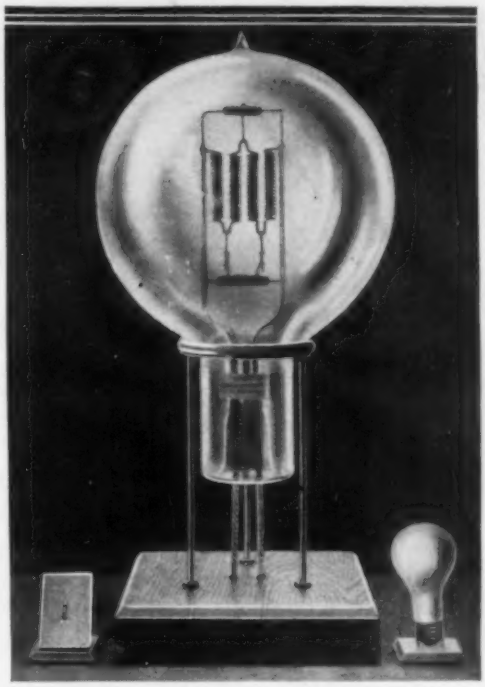
Operated by a storage battery, a miniature automobile, perfect in every detail, has been built by a soldier during his spare time. It has a speed of from six to twenty-

Miniature Automobile Driven by a Storage Battery and Built by Soldier During Spare Time

five miles an hour with three speeds forward and one reverse. In appearance it resembles the larger motor cars.

LIGHT OF HUNDRED THOUSAND CANDLES RIVALED BY BULB

For use in motion-picture production, a giant electric lamp has been made, the light of which is estimated at 100,000 can-



Gigantic Electric Light Contrasted with the Ordinary Lamp and a Tiny One Made for Physicians

dlepower. Its current consumption is about 30,000 watts as contrasted with the fifty required by the ordinary light used in the home. Only about a hundred of these huge bulbs have been manufactured.

HOW DEADLY MOSQUITO WORKS IN SPREADING FEVER

Details of the life of the only species of mosquito which has been shown to transmit yellow fever have been bared by a government scientist. It is a small form, well known in the tropics and is strikingly marked. Its long association with man is shown by many of its habits. The insect approaches stealthily from behind, retreats upon the slightest alarm and usually attacks the undersides of the hands or wrists. It gives no warning, whereas other mosquitoes have a piping or humming note. The pest hides wherever it can, concealing itself in garments, working into pockets and under lapels of coats, and crawling up under the clothes to bite its victim.

Sheathed in a Curtain of Water from Outside Sprinklers, Windows and Walls of a Large Office Building Are Protected from Near-By Fires; Dripping Sides of the Structure Would Prove an Effective Barrier to the Spread of the Flames

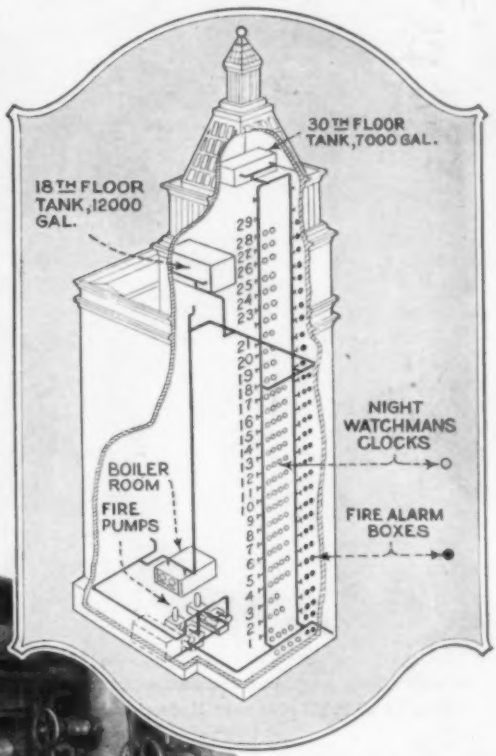
Water Veil Guards Walls of Skyscraper

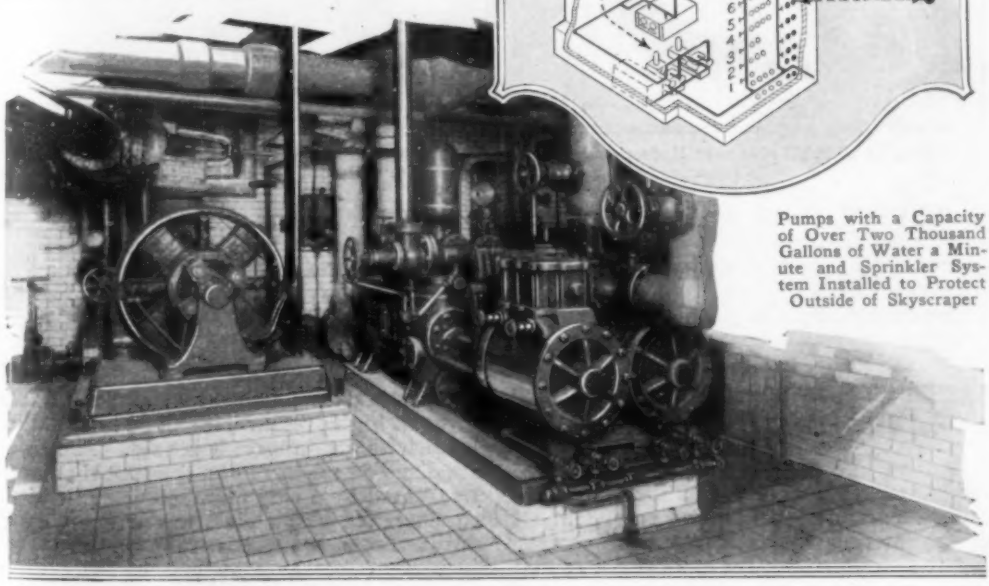
CONNECTED to powerful pumps, a network of 291 sprinklers on the outside of the new Union Central Life Insurance company's building in Cincinnati, Ohio, has been installed to bathe the structure's upper stories in a protecting curtain of water in case of a severe fire in the neighborhood. The sprinklers are similar to those used in interiors, but operate only when the pumps are started.

This installation, said to be the first of its kind on a building of this type, was adopted largely because of the lesson taught by a disastrous fire in Chicago, in 1922, when flames leaped an eighty-foot street, melted windows of heavy wire glass and devoured the contents of several upper floors of a steel skyscraper. The blaze proved that a modern "fireproof" structure, though amply guarded against flames by interior sprinklers, may not be immune from an outside attack. The conflagration further showed that, even if the flames do not actually break through, the wire-glass windows, capable of withstanding from 1,500 to 1,700 degrees Fahrenheit, radiate sufficient heat to endanger books and papers and other inflammable materials.

The system is divided into six units, each placed where it will best protect the exposed sides of the building. Water is supplied directly from the city mains and from storage tanks in the upper floors. Approximately 5,000 linear feet of galvanized pipe, weighing 14,000 pounds, were required to connect the sprinklers.

The "feeders" are attached to the building by fasteners in holes drilled into the exterior terra cotta. Sprinklers are turned downward so they will drain, and are pointed directly at the windows. In case of danger from an outside fire, pumps are started, control valves on the top floor where the entire system is managed, are opened, and, in a short time, the upper stories are bathed in a protecting film of water, pouring at the rate of 2,550 gallons a minute at fifty pounds pressure, upon the outside of the windows.





Pumps with a Capacity of Over Two Thousand Gallons of Water a Minute and Sprinkler System Installed to Protect Outside of Skyscraper

GIANT TURBINE IS INSTALLED AT NIAGARA

Water, pouring at the rate of 3,500 cubic feet a second on the giant turbine of the recently completed 70,000-horsepower hydroelectric unit of the Niagara Falls power company, does work that would require 700,000 tons of coal annually if the energy were generated by steam. So efficient is the generator, said to be the largest in the world, that it uses no more water than was required for seven 5,000-horsepower units formerly, and yet delivers energy equivalent to that produced by fourteen of them. Specially designed cars were required to haul the castings for the turbine, the revolving elements of which weigh approximately 500 tons. Nearly 93 per cent of the efficiency of the water is gained through the fine adjustment of the parts. Another similar unit is being installed and the completed project will house units with a total rated capacity of 454,000 horsepower. Water is to be supplied from the rapids above the falls, for this and proposed units, through a hydraulic pressure tunnel, thirty-two feet in diameter and 4,300 feet long.

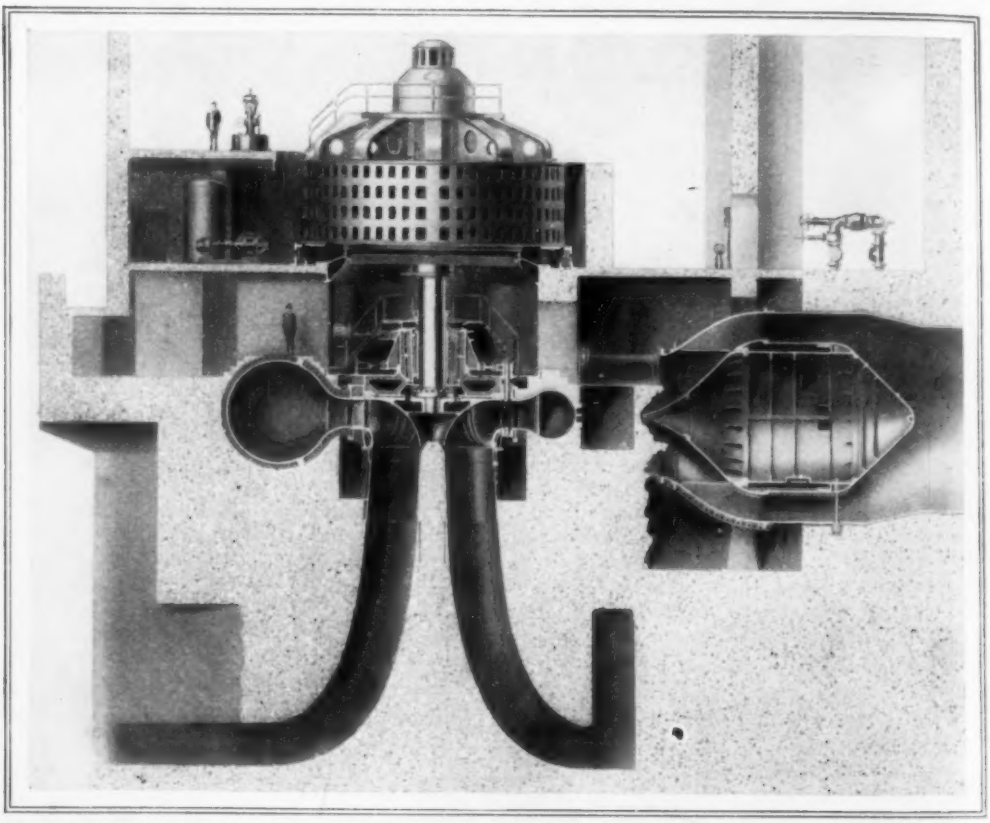


Diagram of 70,000-Horsepower Hydroelectric Unit at Niagara Falls, Showing Arrangement of Turbine and Generator, and Size of Parts Compared to a Human Figure

SAFETY X-RAY TUBE IS BUILT LIKE AN ELECTRIC TORCH

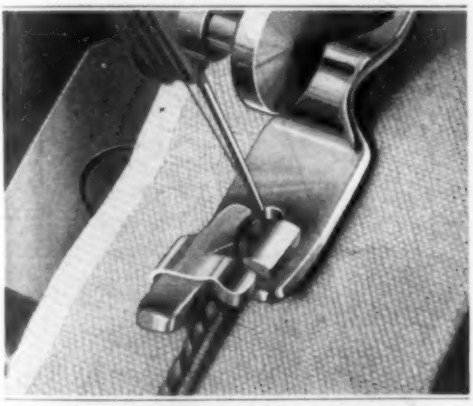
Shaped like an electric torch and projecting powerful X-rays in a focused beam, instead of allowing them to spread in all directions and thus endanger the patient and the operator, a tube has been invented that is said to possess many advantages. Even at high pressure, it can be held in the hand without danger, it is said. The rays are directed exactly upon the spot that is to be treated by a tiny filament heated to incandescence by an electric current which draws them from the tube in a finely focused pencil-shaped beam.

NEARLY HALF OF IRON OUTPUT DESTROYED YEARLY BY RUST

For the last thirty-four years, approximately 21,000,000 tons of pig iron have been destroyed annually by rust, an amount between one-third and one-half of the yearly output of the furnaces of the world, according to the West of Scotland Iron and Steel institute. Battling against this enemy, science is constantly producing noncorroding materials and it is thought that in time modern processes will reduce the destruction of rust to a minimum.

GUIDE FOR EMBROIDERING FITS ANY SEWING MACHINE

Designed so that it can be attached quickly to any make of sewing machine, a guide for embroidering towels, wearing apparel or any other article, has been made to simplify the task and save time. It is not necessary to change any part of the machine, as the device slips on the "shoe" below the needle. A V-shaped notch in



Embroidery Guide Fitted on Sewing-Machine "Shoe," with Thread in Position above Cloth

the attachment aids in following the pattern and holds the thread in place.

MOTOR AND STEAM COMBINED TO RUN NOVEL SHIP

Run by a combination motor and steam engine, a novel ship is soon to undergo tests on the Pacific coast. The lower half of each cylinder acts as an ordinary two-stroke Diesel motor engine for oil fuel, and the upper half as a steam engine, the water being heated outside the cylinder by the exhaust gases. This ship, the "Dolius," has a displacement of more than 11,000 tons.

ICE BOX FOR BOTTLED DRINKS MAKES TEMPTING DISPLAY

For cooling bottled drinks, a unique ice box consisting of a number of J-shaped

Pushing up a Cool Bottle from Curved Chute in Soft-Drink Ice Box

chutes into which bottles are placed, one flavor for each compartment, has been patented. Ice stored in the refrigerator and covering the lower part of the chutes which curve up under the storage chamber, cools the bottles as they pass through. By pressing down on the bottles turned upside down in the delivery tubes, a fresh container appears within easy reach. It is not necessary to open the box to get out a bottle and the row of bottles is visible through a glass cover.

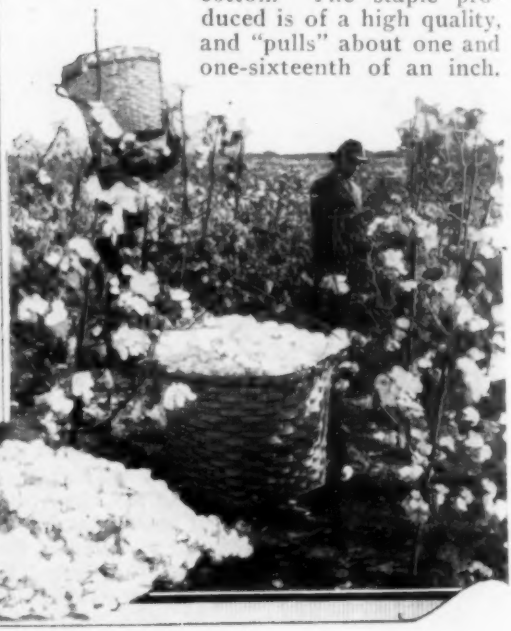
CIGARETTE HOLDER ON RING KEEPS FINGERS CLEAN

To prevent staining the fingers, another type of cigarette holder has been made to be attached to a ring. It prevents the burning of table or desk tops, as the user does not have to lay aside his smoke in order to have free use of his hands. When not in use, the ring may be removed or, if left on the finger, it is inconspicuous.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

"ARMORED" COTTON IS DEVELOPED TO FOIL BOLL WEEVIL

COTTON with bolls so thick that they resist the attack of the weevil has been produced on a Georgia experimental farm, as a result of ten years of breeding, by J. V. Cochran. Starting three hardy and thick-bolled varieties of cotton, he carefully mixed the pollen of each flower with that of all the others. Only the largest, best formed and thickest bolls were used for seed. The lint was taken off by hand, and the seeds again carefully selected, only the hardiest being saved for planting. Each year the bolls became larger and thicker until now they are said to be able to defy the attacks of the pest. Examination of the burrs in the field a few weeks ago revealed that practically every one had been peppered with holes around the stem, but that the cotton had been left unhurt, with very few exceptions. The thickness of the boll had defied the attacks of the weevil. A few bolls near the top of the stalks which were attacked when very small were destroyed, or had lost one or two locks of cotton, but these were scarce. Poison was applied to the cotton while it was small, but, after the bolls had developed, this was said to be unnecessary, as the thickness of their covering provided ample protection for the cotton. The staple produced is of a high quality, and "pulls" about one and one-sixteenth of an inch.



DECREASE IN FARMS IS OFFSET BY GAIN IN OUTPUT

Increased production through intensified farming and improved agricultural methods to a large extent have offset the decrease in farm-land area, according to recent figures. Although population of the United States increased fifteen per cent between 1910 and 1920, farm area showed a net gain of only nine per cent for the period, and in many of the agricultural states, especially east of the Mississippi, there was a loss in the number of acres under cultivation. Nevertheless, government statistics show a net gain in yield per acre for all farms in the United States in the last twenty years, although the new farms were confined principally to semi-arid regions where productivity is relatively small, and the amount of land already under cultivation that was allowed to revert to "unimproved conditions," was almost equal to the total increase in farm area between 1910 and 1920. Economic conditions produced by the war, the growth of the cities and attractive wages paid in factories and other industries are reasons given for the comparative stagnation in farm growth.

ARC LAMP CONCEALED IN HAND MIMICS GLOW OF MATCH

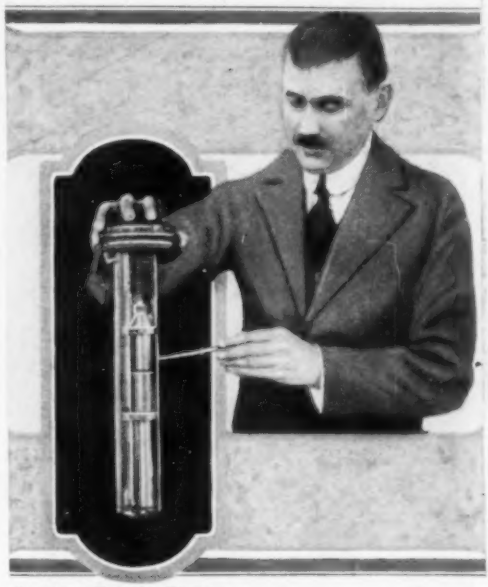
To give a realistic effect of the flare of a match suddenly illuminating the face of a moving-picture actor, a small electric arc

Lighting a Cigarette with Arc-Lamp "Match" Cleverly Concealed in Actor's Hands

light has been made that is fitted into a case hidden in the hand. Darkness screens all wires and as the hands are cupped to form a wind shield, the apparatus cannot be detected. The powerful light shed by this small arc brings out the lines and shadows of the face far more effectively than would be possible with a match.

ROCKET TO "SHOOT" THE MOON TO TEST AIR CONDITIONS

Designed to travel at a speed of six miles a second, a giant rocket has been invented by Prof. Robert Goddard, of Clark uni-

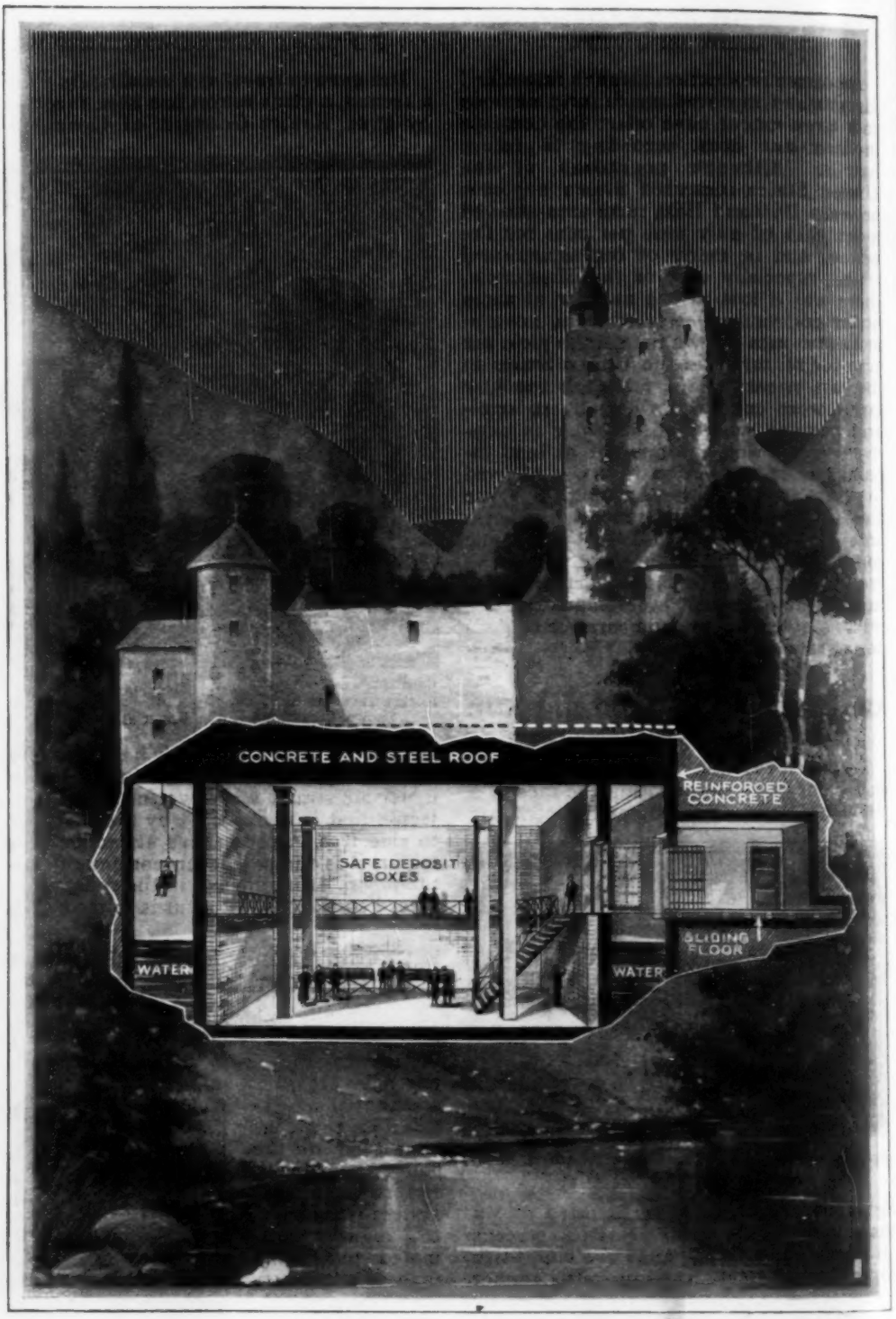


Copyright, Keystone View Co.
Rocket Invented by University Professor to Test Unknown Conditions of the Upper Air Strata

versity, by means of which he intends to investigate the unknown conditions of the upper air strata. So powerful is the projectile that it is expected by the inventor to ride free of the earth's attraction and might, it is thought, even continue on to the moon. Instruments in the rocket will record conditions if it returns to the earth.

BICYCLE THEFTS ARE REDUCED BY LICENSE NUMBERS

License tags on bicycles in Denver, Colo., have reduced materially the number of thefts each year. They are sold at $1 each and have provided substantial additions to the pension fund of the police department. Before the license system was adopted, it was estimated that more than one thousand bicycles were stolen each year and but few recovered. In 1923, after the tags were put on, 695 wheels were stolen and, of this number, 479 were recovered and restored to the owners.



Courtesy, A. C. Bossom

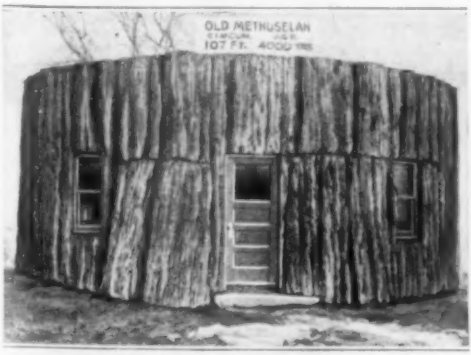
Cross-Section Diagram of Safe Deposit Vault "Fortress"; Left: An Observer in Chair Suspended on Track above Moat; Drawbridge and Connecting Room Are Seen at Right

MONEY VAULT LIKE FORTRESS IS SURROUNDED BY MOAT

Surrounded by a deep moat and covered with a bomb-proof roof, a safety deposit vault, constructed on the lines of a medieval fortress and considered impregnable to raids from land or air, has been built for the Bank of France. Heavy steel girders, and concrete several feet in thickness, form the top, which is impervious to explosives that might be dropped from aircraft. Over the moat, containing twelve feet of water, a sliding floor from an adjacent building provides access to the single entrance of the vault. When the bridge is withdrawn, a steel door closes flush with the walls, guarding the opening to the deposit boxes as the portcullis protects the gateways to old castles. An observer's chair, suspended above the moat from an overhead track, provides a seat for a lookout to watch for attacks from robbers or bombers. The plan was devised by Alfred C. Bossom, of New York, an American architect, and has proved so successful that it is to be used in the construction of other vaults.

TOURIST CAMP IN TREE TRUNK "AD" FOR SCENIC WONDERS

When tourists alight from their automobiles at a camp in a California city, they are confronted with a replica of the trunk of the redwood giant, Old Methuselah, a Sequoia tree, 107 feet in circumference and believed to be 4,000 years old, one of the sights of the forest not far from the city. The unique structure, advertising the



Tourist-Camp Headquarters Housed in Replica of Trunk of Giant Redwood Tree

scenic wonders of the district, houses the headquarters of the camp from which information and aid are given to travelers. Bark was used for the sides of the building, the furniture was made of redwood and a fireplace was constructed of native granite.

COPPER "MINES" UNDER STREETS SPEED CITY'S PROGRESS

Threaded along underneath the streets in modern cities are thousands of miles of electric-light and telephone cables, vigilant,

Copyright, Underwood & Underwood

Arrangement of Different Cables in a Manhole Copper "Mine" in New York City

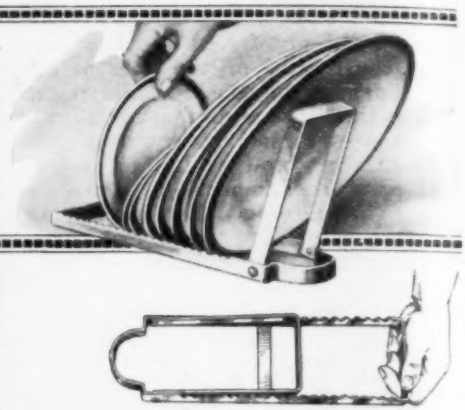
hidden nerves that respond to millions of calls every day. In Chicago, the copper in the lines of the subsurface telephone cables alone weighs approximately 35,000,000 pounds and is valued at $6,000,000. If connected in one single strand, it would reach from New York City to Portland, Ore. Concrete-lined manholes and carefully constructed conduits are made for protecting the cables in their "mines" beneath the busy pavements.

TRACTOR WALKS ON TWO LEGS

In place of the front wheels, a farm tractor, invented by a Swedish engineer, has two steel "legs" that walk in almost human fashion. They are actuated by the motor that drives the two rear wheels and may be fitted with shoes of various shapes best suited to give the most traction in different kinds of ground. The tractor pulls a plow which is guided by a man walking behind. The legs are said to adapt it to wet or soft soils.

Time and Money-Saving Tools

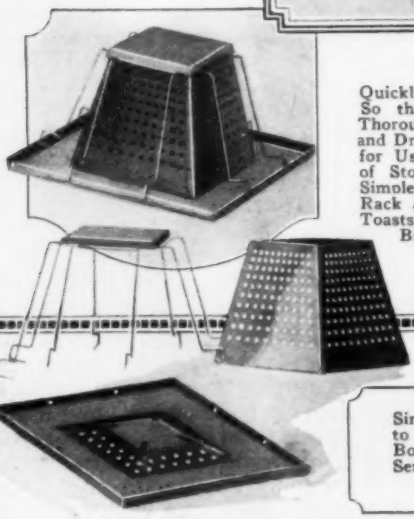
Attractive Metal Holder that Conceals Stains on Glass Baking Dishes; Can Be Adjusted to Sixteen Sizes



Notched Metal Rack for Draining Dishes; Has Space for Twenty-Four Plates and Folds Up when Not in Use; High, Strongly Secured Brace Prevents Collapse and Keeps Dishes from Falling Out; Fits on Sink Drain Board

Metal Basin Clamped with Spring Hooks to Flowerpot to Catch Excess Water

Trough-Shaped Ring with Rubber Washer Fitted on Teapot Spout to Keep Drippings from Soiling Tablecloth

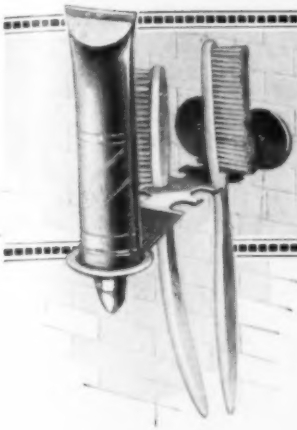


Quickly Taken Apart So that It Can Be Thoroughly Cleaned and Dried, this Toaster for Use on All Kinds of Stoves Has Three Simple Parts, Base, Rack and Shield, and Toasts Four Pieces of Bread at Once

Simple Siphon Arrangement to Take Cream from Milk in Bottle; Pressure on Bulb Sends Pure Cream Flowing into Smaller Jar

Anyone wishing further information on devices described in the editorial pages can

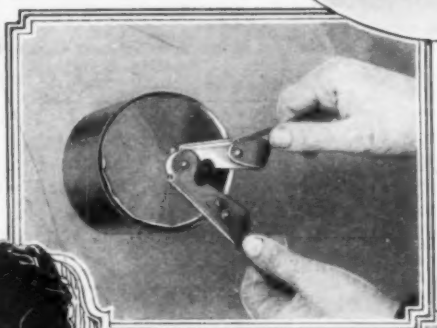
for Woman's Workshop in Home



Tooth-Paste or Shaving-Cream Holder with Valve Top that Cannot Leak Fitted into Handy Tooth-Brush Bracket; Holder Cap Is Furnished as Part of Bracket So that Tube Does Not Have to Be Removed; Is Simply Squeezed into Place

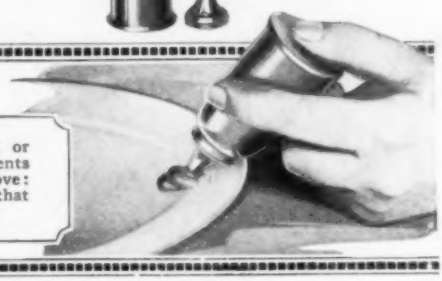
Above: Mincing Onions without Shedding Tears Is Easy with Chopping Blades Tightly Inclosed in Glass Jar

Durable and Capacious Steel Dustpan with "Hump" near Edge that Keeps Dirt from Falling



Left: Safety Can Opener with Strong Clamp; Holds Can and Cuts Top at Same Time; Hands Do Not Touch Tin

Left: To an Ordinary Milk Pail, an Easily Cleaned Dome Cover, with Straining Cloth Held in Place by Spring Wire Clip, Is Attached to Keep Out Dirt, Dust and Hair; also Has Tightly Fitting Lid Closing over Spout when Milking Is Done



Metal Tube for Mustard or Salad Dressing that Prevents Waste and Spots; Above: Filling Rubber Barrel that Fits Inside Container

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago

GUN WITH TWENTY-MILE RANGE RUNS ON RAILS

Capable of hurling an armor-piercing projectile that weighs 1,560 pounds for a distance of over twenty miles, a 14-inch, 50-caliber, gun has been completed under the direction of United States army ordnance experts. The gun and carriage weigh 700,000 pounds, and the wheels are gauged to fit an ordinary railroad track so that it can be moved quickly from place to place. The barrel is lowered for passing through tunnels or raised and adjusted for firing positions by electrically driven apparatus within the carriage.

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Mighty Gun for United States Army Completed and Mounted on Railway Carriage that Supports Three Hundred and Fifty Tons of "Fighting Steel"

CANTILEVER SPRINGS ON CYCLE SEAT ADD TO COMFORT

Supported by two pairs of cantilever springs, a cycle saddle has been designed by an English inventor to give greater riding comfort. The motion of the leaf springs is said to take up the shocks effectively. As there are four supporting members, two on each side, the arrangement gives greater strength and does not "bounce" the rider, but allows a sagging movement when the machine hits a rut.

Motorcycle Seat Supported by Four "Shock-Proof" Cantilever Springs Attached to Frame

"PEN" FILLED WITH MUCILAGE MAY BE CARRIED SAFELY

Filled with mucilage or liquid glue, a convenient "pen" that prevents unsightly smears and sticky fingers has been invented. The adhesive is kept securely in the barrel of the device and is released, a drop at a time, when the point is pressed upon the object to be glued. A strong spring on the tube at the end closes it each time the pressure is released. The pen may be carried without mishap in the pocket and is easy to fill.

¶ More than 8,000 shipwrecks have occurred on the coast of Great Britain in the last forty years.

STRANGE ANIMAL BEING SOUGHT IN HEART OF JUNGLE

Deep in the depths of East African jungles, the "Nandi bear," depicted by natives as a ferocious species of man-eating hyena with striped skin, is being sought by scientists. The tales of frightened villagers and fragmentary reports from hunters indicate that the animal is taller and much more powerful than the ordinary hyena. In the last ten years, extensive explorations have resulted in the discovery of many new animals, among which the okapi, a large zebra-like creature, is regarded as the most important. Smaller animals are constantly being found and the old Roman adage, "Out of Africa, always something new," is almost daily proved true. Scientists believe, however, that there are few of the larger species that have escaped identification.

BATTERING RAM IS POLICE "KEY" TO BARRED DOORS

Aiding police in raids on gambling places in a western city, a torpedo-shaped battering ram of steel has proved effective. The instrument weighs 150 pounds and has two projecting handles by which it is grasped and swung. In the hands of strong policemen, its force is sufficient to shatter stout locked doors or other barriers. This formidable "key" has been known to open various portals that resisted ordinary means of entrance.

HORSEPOWER OF PIGEONS TOLD BY CORD TIED TO LEG

For recording the flying speed of a pigeon, one end of a thread, which is wrapped on a reel, is tied to the bird by experimenters before it takes flight. As the cord unwinds, the number of revolutions made by the spool is automatically counted on a strip of paper marked off in fifths of a second. A small brake attached to the wheel shows the amount of force exerted and registers the "pull." It is said that a pigeon weighing about a pound can equal one-thirtieth of a horsepower while flying.

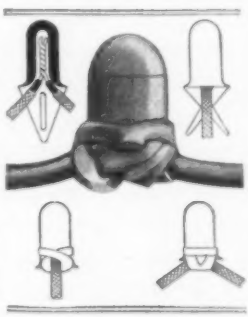
BABY TANK IS BUILT BY BOY TO NAVIGATE RIVER

Similar in appearance to the land tanks used during the war, a queer boat has been built by a boy in England. It is propelled by a paddle like a canoe and provides room for only one passenger. The novel craft attracted much attention when it appeared during a regatta on the River Thames.

Baby Tank that Rode the River Thames, Propelled by the Paddle of Its Owner

RUBBER CAP ON WIRE JOINTS DOES AWAY WITH TOOLS

To save time in securing and insulating wire joints, a rubber cap has been invented. There are no tools to use, porcelain to break or screws to lose. When fitted over the twisted ends, the cap holds them tightly together and prevents any leakage of current. They are said to be less costly and to result in a saving of time.



¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine.

ELEVATOR RESISTS JAP QUAKE THAT DESTROYED BUILDING

Among the strange sights witnessed after the earthquake in Japan, was an American-built elevator standing amidst

Elevator Shaft that Defied the Earthquake in Japan While Building Housing It Was Destroyed

the ruins of the building that had housed it in Yokohama. While everything about it had crumbled into ruin, the shaft was uninjured, although it was left leaning slightly to one side because of the collapse of its supports. The lifting machinery was not harmed.

SPRING BRAKE ON FARM WAGON SAVES HORSES AND DRIVER

Wagon brakes are automatically set when the horses stop, thus keeping the weight of the load from the holdback straps and collars, by a patented spring arrangement designed so that it can be attached to an ordinary farm vehicle. It is connected directly with the doubletrees. As the horses start, the pull is exerted on the spring in front, thus making the load easier to start, as the force reaches the wagon gradually. This forward movement also releases the rear spring pressure on the brakes. In going down hills, the hand brake is available. The device saves the labor of locking the handle in the ratchet each time the wagon is stopped, eases the work of the horses and of the driver, and saves wear on the harness.

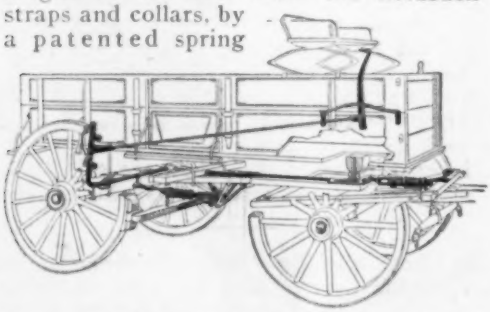


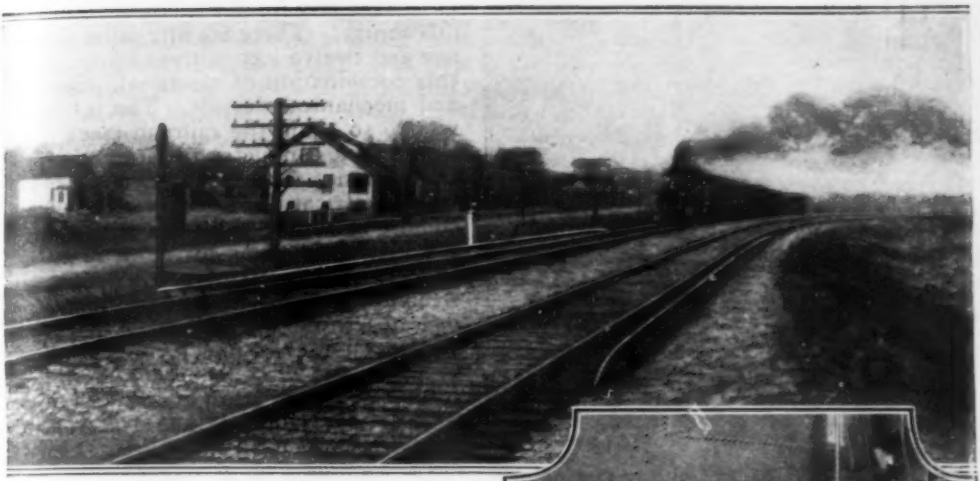
Diagram of Wagon with Spring Brake Gear Attached to Hand Rod and Doubletrees

CLIP KEEPS RULER IN POCKET AND PREVENTS ITS LOSS

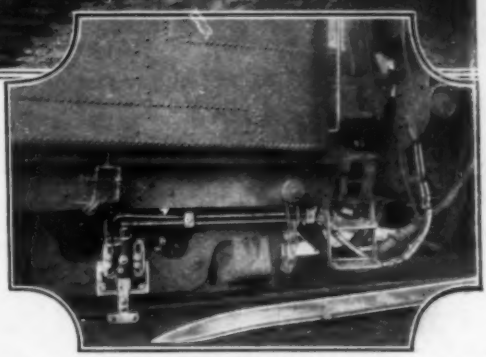
To prevent a ruler from slipping out of the pocket, a flat metal guard has been made that is somewhat similar in principle to the familiar fountain-pen clip. It is provided with two spring tensions, one of which holds the clip to the ruler while the other grips the edge of the pocket. The whole device is flat enough to be used even with folding rulers, for it will slip in between the sections without causing them to spring apart.

TREASURE IN BURIED TIMBER IS FOUND IN SWAMP

While buried timber has been used for many years in furniture making, it has never been found in large quantities until a large tract was located in the Papakura valley, not far from Auckland, in New Zealand. Here some upheaval of nature in the far bygone ages laid low a vast acreage of great kauri trees. As time passed, they became covered with a layer of semi-liquid peat, into which their branches and crowns have disappeared. Today the swamp in which they lie is a busy place. Great chunks of the lumber are being reft away from where they have lain for a century of centuries and more, and hauled to the sawmill. It differs from the wood cut from the living tree both in its strength and hue, which is of a dark red-brown, rather like mahogany.



Danger of Wrecks to Be Lessened by Automatic Control

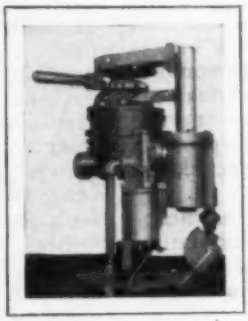


Shoe Bracket, Air Pipe and Coupling of Automatic Control, and Train on Protected Track

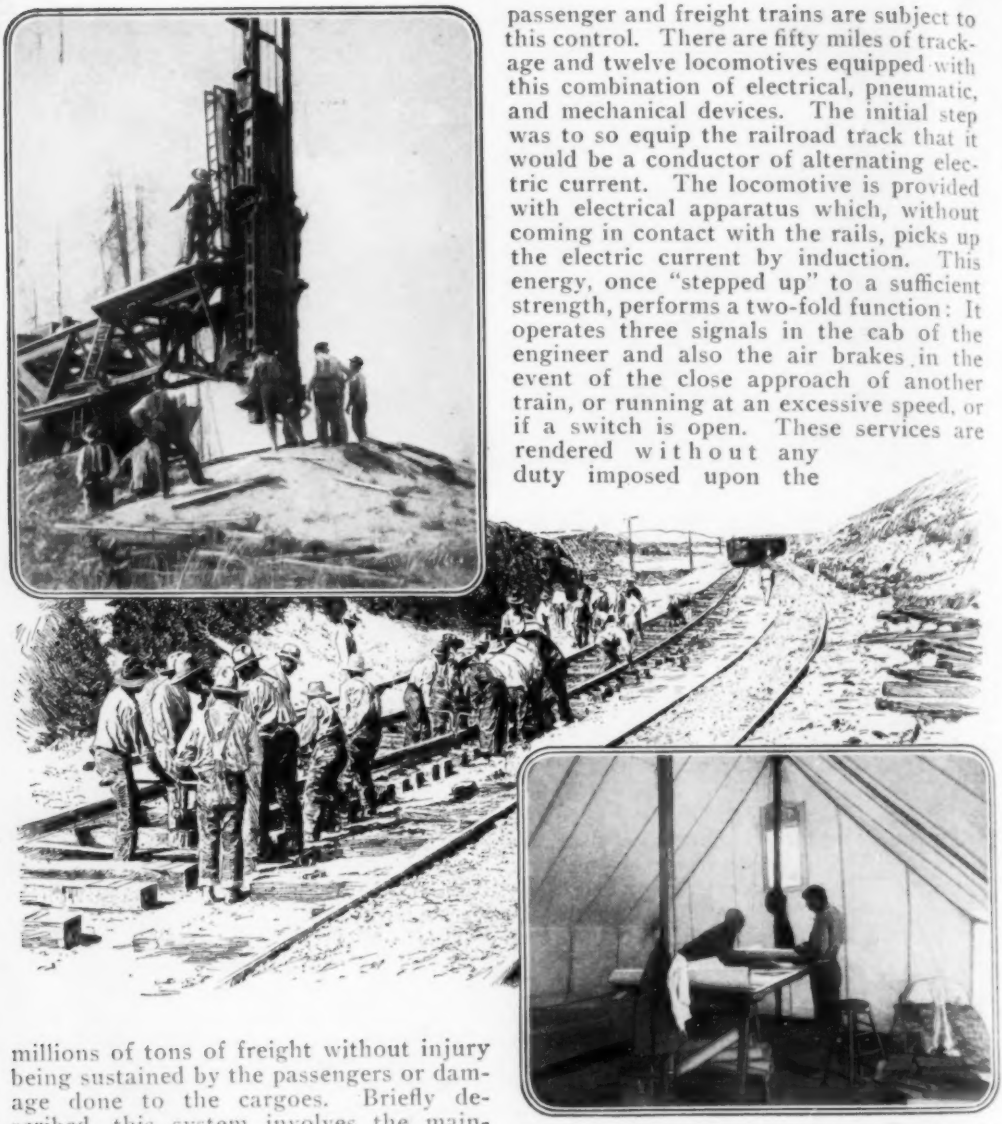
MORE than a billion and a half dollars will be spent by the railways of the United States during the coming year in a comprehensive and impressive program for construction work, new facilities and improvements, according to present estimates. Expenditures totaling in excess of $50,000,000 are planned by the Southern Pacific alone. This is in addition to the recent purchase by that company of a record number of freight, passenger, and refrigerator cars and powerful locomotives at a cost aggregating $40,000,000.

Included in the improvements are the building of new lines, extensive double tracking, construction of freight terminals, creosoting and rock-crushing plants, station buildings, additions to shop equipment, replacing and strengthening bridges, line changes to eliminate curves, better ballasting and heavier rails, tunnels and improvements to existing tubes.

In addition to these expenditures, great sums already are being spent to comply with an order issued by the interstate commerce commission which makes it obligatory that forty-nine of the principal roads of the country install automatic train-control devices on 5,000 miles of their lines by January 1, 1925. Recognition of the fact that locomotive engineers are no more infallible than individuals engaged in other endeavors of great responsibility, marks the development of mechanical, pneumatic, and electrical means for stopping a train when life and property are threatened. Such automatic devices are not new. In fact, one or more systems of control have been continuously in operation since 1914. These, or similar mechanical methods of averting collisions, have been voluntarily introduced in an experimental way on about twelve railways. One system was first installed on the Chesapeake and Ohio railroad in October, 1911. For the succeeding three and one-half years continuous experiments were conducted, resulting in the equipment of 107 miles of double railroad track and 103 locomotives in 1914. This system of robbing train operation of some of its dangers, has been used in the handling of millions of passengers and hundreds of



Air-Brake Control in Cab and Automatic Device

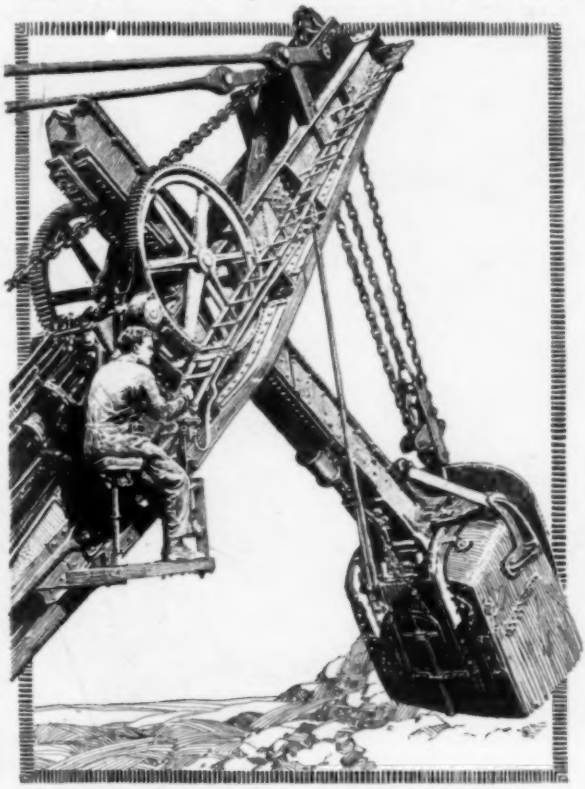


Bridge Builders, Track Layers and Engineers Busily Engaged on Great Railway Extension Program

millions of tons of freight without injury being sustained by the passengers or damage done to the cargoes. Briefly described, this system involves the maintenance of ramps, or stop locations, at intervals alongside the railroad track. The locomotive passing over these is equipped with iron shoes. The latter are brake-applying mechanisms, and, if the ramp is connected with a source of electrical energy, the iron shoe is inoperative and the locomotive proceeds without interruption. If, however, the ramp is disconnected, the train is stopped automatically.

As recently as August, 1923, an automatic train-control system under operating conditions was under the critical observation of officials of the Pennsylvania. Approximately twelve months were required for making the installation, and now all passenger and freight trains are subject to this control. There are fifty miles of trackage and twelve locomotives equipped with this combination of electrical, pneumatic, and mechanical devices. The initial step was to so equip the railroad track that it would be a conductor of alternating electric current. The locomotive is provided with electrical apparatus which, without coming in contact with the rails, picks up the electric current by induction. This energy, once "stepped up" to a sufficient strength, performs a two-fold function: It operates three signals in the cab of the engineer and also the air brakes in the event of the close approach of another train, or running at an excessive speed, or if a switch is open. These services are rendered without any duty imposed upon the engineer or fireman. The three electric bulbs in the cab of the engineer continuously inform him of conditions ahead. The bulb marked "A," when illuminated, tells the engineer that the track is clear for at least two sections ahead. Maximum speed may be attained, but attempts to exceed it bring into play automatic air brakes. The bulb containing the letter "R," when lighted, indicates that there is one clear section, but that another train or an open switch is in the second section. Then the speed of the train is automatically confined to "medium speed," or about thirty

miles an hour. The third bulb, labeled with the letter "S," when burning, is a warning that at a point about 1,800 feet away there is an open switch or the track is occupied by another train. If the engineer disregards this signal, the device applies the air brakes and stops the train. The cost of meeting the requirements of the interstate commerce commission varies with the type of mechanism, number of locomotives, and the extent of the installation. The expense of the automatic train stop of the ramp design is $500 per engine and $300 per ramp, the Chicago & Eastern Illinois railway equipping eighty-five engines and placing 175 ramps over 105.4 miles of double track at an aggregate investment of $95,000. Thus the cost for each mile of track for this control is $451. Other than the safety precautions introduced by automatic train-control devices, the cost of their installation and maintenance is minimized when the damages caused by railroad accidents and the death and injury claims paid by common carriers are brought into review. The damage to railroad property alone by reason of train collisions has been estimated at $40,969,633 during the last fifteen years. Thus the railroads of the United States annually sustain property losses to the extent of $2,560,603 on account of human failures. Losses due to damage of goods in transit are not included in these figures. Moreover, the death and injury claims paid as a result of train collisions are staggering to contemplate. For instance, one eastern road paid $412,210.91 upon death and injury claims when two trains collided and twenty-one persons were killed and forty-two injured. Two other accidents on this same carrier demanded the payment of $131,543.98 and $29,580.44, respectively. Thus the total claims paid for three accidents totaled $573,335.33. Another system paid $226,616.54 upon death and personal-injury claims in consequence of one collision, which accident took a toll of 23 lives and injured 125 persons. Three other collisions on this same railway system together with the one just indicated, swelled the claims paid to the amount of $959,214.68. Within ten years, a third road was called upon to settle death and injury claims to the extent of $367,360. The property losses sustained and claims paid by railroads, great as they may appear in the aggregate, are inconsequential compared to the loss of life and injuries caused by the coming together of two speeding trains or the result of a fast-moving locomotive running into an open switch. And, yet, the interstate commerce commission, after studying the causes of railway accidents, frankly states:



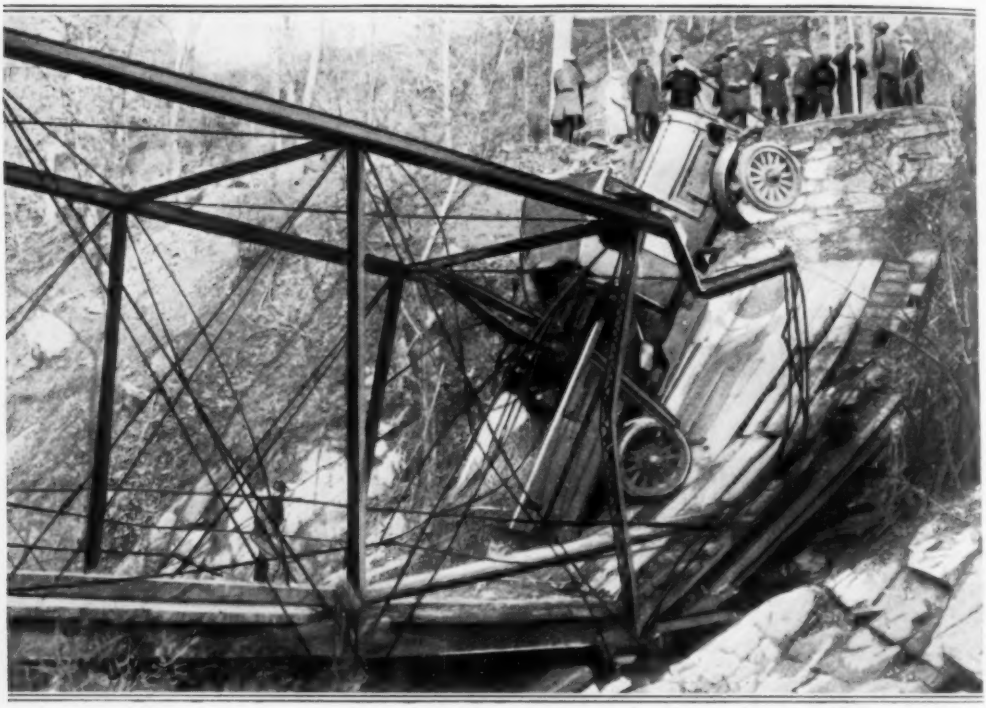
Type of Monster Steam Shovel which Has Made Possible the Leveling of Grades and the Cutting Away of Mountains

"The conclusion is inevitable that disastrous collisions will continue to occur unless and until automatic train-control devices are installed to protect against human failure."

This conclusion is based upon an investigation embracing eighty collisions occurring over a period of eleven years on the present automatic, block-signaled lines. The cause of these accidents, resulting in the death of 416 persons and injuring 1,837, is declared to be due directly or indirectly to the failure of trainmen to observe or to be governed by the indications of the signals. The installation of automatic control will make accidents nearly impossible.

TWENTY-FOOT FALL FAILS TO INJURE TRUCK

Plunging twenty feet down a steep embankment when a bridge collapsed, a motor truck fell into Plymouth Run, Va., without injuring either of the two occupants. One of the remarkable features of the accident was the slight damage sustained by the vehicle, which was pulled back to the road with a hoist and tackle. After a few minor repairs had been made it was put back into regular service.



Motor Truck Being Pulled from Ravine into Which It Was Plunged by Collapse of Bridge It Was Crossing Without Injuring Either of Its Two Occupants

WRENCH LOCKED BY THUMB IS RELEASED BY SPRING

So it can be manipulated easily by one hand, a wrench has been made with a movable jaw that locks on a nut by pressure from the thumb. Said to be of aid when working in small corners or against walls, the tool can be released instantly by a spring located in the handle. The grip is shaped to permit a firm hold with either hand and gives a strong leverage for turning. Much time may be saved with the device in adjusting a number of nuts or bolts of different sizes, as it can be quickly fitted.

How Grip of Wrench Is Locked by Thumb and Released by Touch of Spring

SUBMARINE VOYAGE TO SOLVE NAVIGATION MYSTERIES

When Jules Verne wrote his famous narrative, "Twenty Thousand Leagues Under the Sea," it was regarded generally as a dream that would never come true. But at last it seems to have done so, a British submarine having set forth on a voyage that in one respect will approach closely to that which the French writer described. The trip is to last three months, during which time the crew will travel approximately 10,000 miles beneath the surface. All the day round they will live in a super-

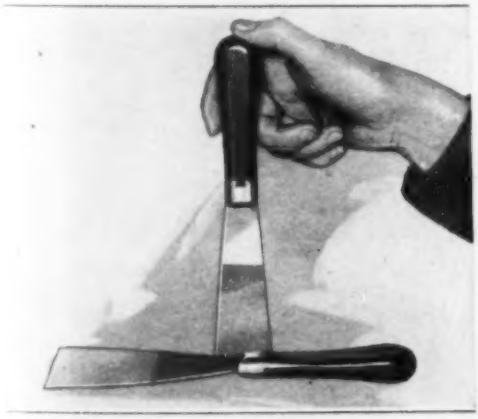
heated atmosphere with powerful incandescent lamps blazing overhead. The voyage has been undertaken for experimental purposes, one of which will be the finding of a solution of the puzzling problem of wireless "blind spots" at sea. There are certain areas in which wireless messages can be neither sent nor received. Nobody knows why, and all the probing done so far has failed to reveal the cause of this strange freak of the atmosphere. Another important matter is the testing of recent improvements in the design of submarines which might make them available as cargo carriers in case of another war.

HEAT FOR TWENTY THOUSAND SUPPLIED BY ONE PLANT

Homes and buildings in a Minnesota city of 20,000 inhabitants are warmed by steam from one municipal heating plant. The single-unit arrangement has been widely developed in large industrial plants and institutions, and in towns and cities is said to save householders money on the annual coal bill, and to spare them the trouble of caring for their own furnaces.

PUTTY-KNIFE HANDLE MOLDED AROUND BLADE FITS HAND

To prevent it from working loose, the handle of a putty knife is being made of a patented compound. In securing it to the blade, it is melted and molded on under intense heat, resulting in a handle hard as stone, very tough and yet smooth to the touch. It is so shaped that the hand fits around it naturally, increasing the efficiency of the worker.



Putty Knife with Molded Handle that Fits the Hand and Will Not Work Loose

WRITING GUIDE HELPS BLIND KEEP LINES STRAIGHT

To aid blind persons in writing, a pad in a metal guide frame, to which is attached a cross bracket inclosing space one line wide for the pen, has been devised. By means of studs and holes at equal distances along the sides of the frame, the spacer is moved down the page as each line is written. With this invention, straight lines and regular margins are made easily by sightless writers.

Guide for Blind Writers Showing How Adjustable Spacer Is Moved Down the Page

GLUE PUT IN DOVETAIL JOINTS BY MESHES ON ROLLER

For spreading glue in the dovetailed ends of drawer sides without a brush, an aluminum wheel with a rim cut to fit the irregular joints and mounted in a frame to be placed over the glue container has been designed. As the wheel is rotated, the side dips up fresh glue. The work is advanced by hand across the top of the frame and the dovetail joints are meshed with the projections in the rim, each one of which has been given a liberal coating of glue from the pot below. Even spreading, less waste and quicker operation are claimed for the invention.

¶When you want anything and do not know where to get it, write Bureau of Information, Popular Mechanics, Chicago.

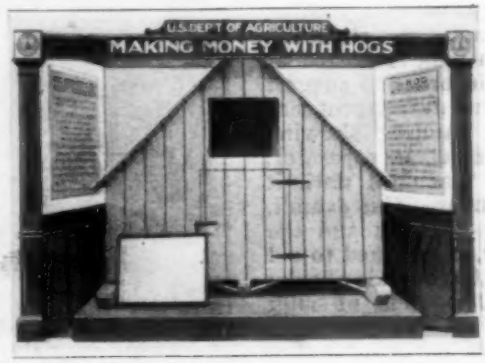
Scientists and Skilled Scenic Artists in Government Workshop in Washington Preparing Realistic, Life-Sized or Miniature Educational Exhibits, Charts, Maps and Pictures to Spread the Practice of Better Farming at Expositions and Agricultural Meetings in All Parts of the Country

Farm Magic Taught with Model Exhibits

Better Methods Are Shown in Displays Built by Uncle Sam and Viewed by Millions of Persons in All Parts of the Country

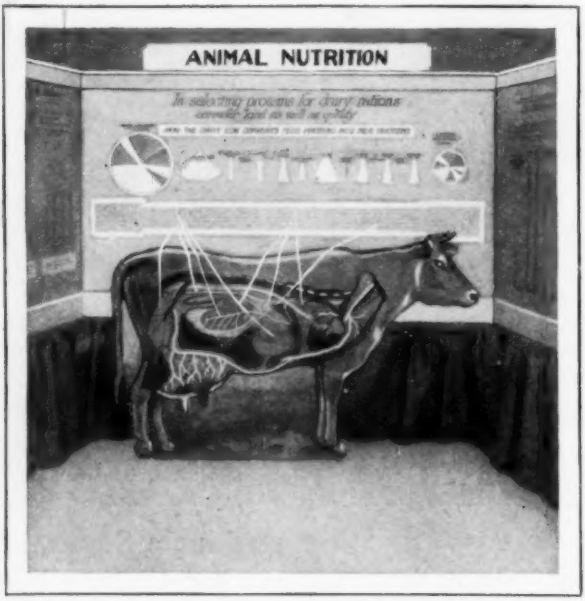
IF it were practicable to assemble all the persons who witnessed the educational exhibits of the department of agriculture during the last fiscal year under one roof, the immense gathering would represent one-thirteenth of the entire population of this country or about 8,000,000 persons. At it was, however, the models, objects, charts, maps, pictures and other forms of demonstrations of the office of exhibits, were carried afield and shown at 114 fairs, expositions and agricultural meetings.

The exhibit—whether taking the form of a painting, a map or an animated model—is one of the most effective mediums for spreading the practices of better farming. The fruits of research in the laboratories at Washington, the object lessons learned in the field by representatives of this department, and the results of investigational activities observed far and near, are faithfully and pleasingly reproduced in life-size or miniature form and exhibited throughout the nation. At the workshop of the department in Washington a staff of exhibit preparators and a crew of workers are continuously engaged in the taking of some scientific truth, difficult of presentation, and fashioning the material into an exhibit that will at once invite attention, and teach an object lesson. Not unlike the presentation of motion pictures, the skillful showing of animated models requires "tricks of the trade" in producing realistic effects. The duplication of a cow in model form is easy enough. However, it is extremely difficult to copy the resemblance of this animal in the act of taking food and digesting it for conversion into milk and butter. In a manner, however, this very thing was done. The cow is built up of wall board, with the circulatory system composed of rubber tubing, painted in colors so as to partake of the reality of the heart, arteries and veins in an honest-to-goodness cow. Hence, this make-believe animal has been referred to as a "rubber cow." A portion of the superficial cow painted on this board is carved out to show the digestive and circulatory systems. Here is shown what takes place when feeds are made into milk. The heart of this symbolic cow is made of a hot-water bag, and the arteries and veins are built up of very thin walls so as to permit of their ready contraction



Portable Hog House Inside of Which Moving Pictures Show Better Ways of Feeding and Breeding

Scientists and Skilled Scenic Artists in Government Workshop in Washington Preparing Realistic, Life-Sized or Miniature Educational Exhibits, Charts, Maps and Pictures to Spread the Practice of Better Farming at Expositions and Agricultural Meetings in All Parts of the Country



"Rubber Cow" Model with Heart, Arteries and Veins to Show How Feeds Are Made into Milk

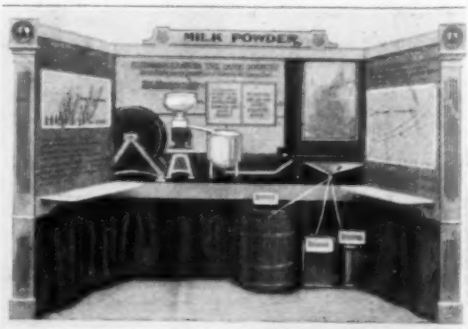
and expansion. The system of rubber tubing is connected to an air pump which causes the heart, arteries and veins to pulsate. The sheep industry in the United States is of such magnitude that the approved feeding and breeding practices could not be presented by ordinary methods in a restricted space. The office of exhibits sidestepped this obstacle by telling the story of wool and mutton-producing animals on a belt of motion-picture film. Since, however, such exhibitions are largely shown during daylight another difficulty of presentation came to the fore. Consequently, a transparent daylight screen was employed and the pictures are projected thereon from an automatic picture machine.

The utilization of skim milk for human food, by converting it into milk powder, represents a growing industry. However, still much of this skim milk is wasted or inefficiently used, and in order to suggest an economy factor, the department has built a diagrammatic painting showing skim milk coming out of a cream separator, then through various machines until it runs into a drying chamber. This exhibit, by the interest which it elicits and the object lesson it teaches, is designed to aid in converting 18,800,000,000 pounds of skim milk into 1,800,000,000 pounds of milk powder annually.

There are two ways of marketing hay—one, consigning the bales to market by freight; the other, feeding the hay to livestock and marketing the cattle. The latter is represented as generally the more economical of the two methods, due partly to the smaller cost of shipping the less bulky product. The two ways are cleverly contrasted in exhibit form. Two men, a platform, and the roof of a pictured railway station are shown. The bales of hay, in fact, are shredded raffia contained on wire screens, which representation is stained green. The cattle pens and the freight cars, as realistic as they may appear, are the results of applying the artist's brush.

Swine production is shown graphically by use of a belt of film reeled off within a portable hog house. Under the title of "Better Breeding and Feeding," the influence of pure-bred sires in transforming an unprofitable farm into a profitable one is depicted. The scenery of the good farm is painted on wall board, set back about eighteen inches from the front opening. About five inches from the front opening is a screen on which is painted the same farm, of several years previous, showing inferior cattle and run-down conditions. A bank of electric lights is properly placed for illuminating the screen and yet they are installed at such a sharp angle that the rear of the exhibit is not lighted. By means of another row of electric lights, which are flashed on and off, the same farm, under the better conditions, appears in place of the poor farm.

Boys' and girls' club activities also are presented in the form of exhibits. A part of the program is presented by teams of boys and girls who demonstrate how to do farm duties by improved methods.



Turning Skimmed Milk into Powder in Miniature Plant to Teach More Efficient Methods

HAND-TURNING IS COMING BACK AS STYLE IN WOOD CHANGES

Automatic wood-turning machinery capable of quantity production in standard patterns and designs has been unable to cope with the growing market for novelties in furniture and more elaborate carving in woodwork. As a result, the skilled worker at the hand lathes, whose trade was once thought doomed by the installation of automatic equipment, is in great demand. Nearly every large wood-turning company employs several such craftsmen and many have established small shops where nothing but hand work is done. A large Chicago company that made more than 100,000 floor lamps last year found it more profitable to do most of the work by hand than to equip its eleven power machines for the job. Decorations for phonographs, radio cabinets, smoking sets, and cabinets for Chinese games, samples of furniture for advertising purposes, and many other articles needed in quantities too small to make it pay to adapt the power lathes to the contract have furnished work for the skilled hand-lathe operator.

BAND HEATED BY ELECTRICITY FITS ANY POT OR PAN

Any pan or pot may be converted quickly into an electric cooker with a metal band which fits snugly around the outside of the

Converting a Sauce Pan into an Electric Cooker with Adjustable Heating Pad

receptacle and is heated by current from a light socket. By turning an adjustable spring screw, the band is adapted to utensils of various diameters. The ring is broad so that the heat is evenly applied to the sides of the pan. With it cooking can be done on any fireproof surface so that the expense of a stove or plate is saved. The band has proved especially successful when used with utensils of aluminum, as that metal is an excellent conductor of heat, thus requiring little current.

PHOTOS TAKEN WITHOUT LENS IN LIGHTPROOF CLOSET

Photographs made without either a lens or a camera attracted much attention at a recent exhibit in New York. The process

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Nest of White and Red Electric Lights Used in Taking Photographs without a Lens

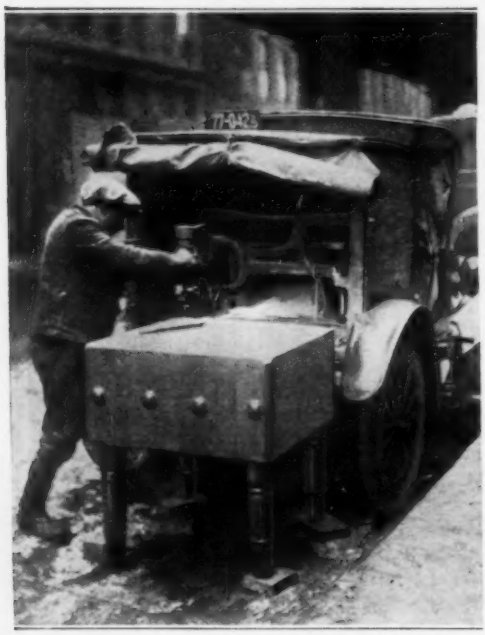
by which they were taken begins and ends in the darkroom, and is somewhat similar to the commercial blueprinting process. The operator shuts himself up in a lightproof closet with red and white electric lights, the objects he desires to photograph and a plain sheet of sensitized printpaper. The posing is done under the neutral glow of the colored globe in front of the vertically placed sheet. Then the burning white light is switched on and moved about until the chemical emulsion upon the paper darkens and images appear.

TRAINS AUTOMATICALLY LIGHT AND EXTINGUISH LAMPS

Lonely stations that do not have night agents are lighted at the approach of passenger trains by means of an automatic switch attached to the rails three-fourths of a mile from the depot. As the train thunders over this point, a circuit is closed and the station lights snap on. The same distance beyond, they are turned off as the train passes over a device that releases the circuit. The arrangement was devised by the Southern Pacific railway for the protection of persons getting off at the stations and for the guidance of engineers on the swift through trains. A saving in bills for electricity also has been effected.

BUTCHER BLOCK RE-SURFACER IS RUN BY AUTO MOTOR

For re-surfacing butcher blocks, a device has been invented that is mounted on



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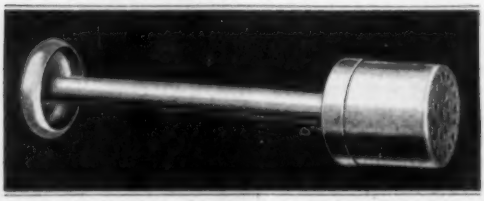
Butcher Block Re-Surfacer Mounted inside Small Automobile and Driven by Power from Motor

the body of an automobile and driven by the motor. It consists of two arms carrying saws which can be moved in any position. The operation is started from the part that is worn lowest and the rest is cut off until a true face is obtained.

CREAM SEPARATOR FOR BOTTLE LIFTS BY AIR PRESSURE

Without a single moving part, an aluminum cream separator has been made for bottles. All it consists of is a hollow tube attached to a small cylinder which is in-



Separator that Lifts Cream from Bottle When Finger Is Placed over Opening at End

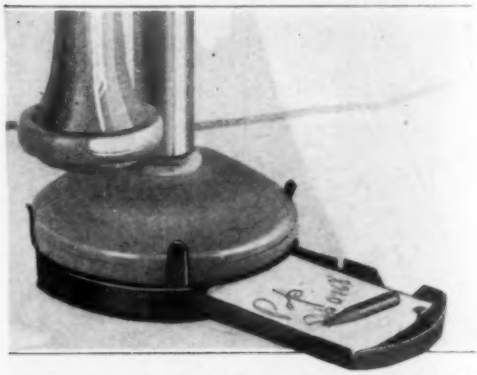
serted in the neck of the container. When it is filled, the finger is placed over the tube that also serves as a handle. The admission of air being stopped, the liquid remains in the holder when it is lifted out, until the finger is removed.

BRASS-RIMMED FUSE-BOX DISK REPLACES BLOWN PLUGS

By means of a brass-rimmed mica disk designed to be inserted when an electric plug has been blown, the fuse box is quickly repaired. The disk fits over the center of the socket and is held in place when the fuse is screwed back into position. The circuit is completed by a fine wire running from the center to the outside rim which comes in contact with the socket.

HIDDEN PHONE-STAND DRAWER HOLDS PENCIL AND PAPER

Containing a small drawer that holds pencil and pad for taking notes, a metal telephone stand has been devised to save table space. It opens when a trigger at the side is released and snaps shut when the conversation is ended. Being the exact size of the phone base to which it is clamped, the bottom of the stand is covered with felt to protect varnished and polished



Telephone Stand with Spring Drawer Containing Pad and Pencil for Taking Notes

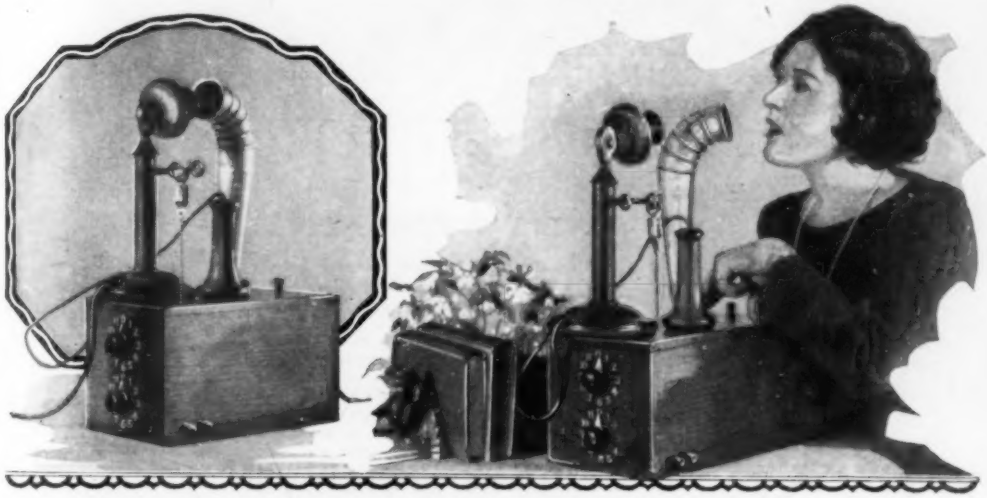
surfaces. The drawer holds sufficient paper for many notes, and clips in the bottom keep the pad from moving about when used for writing.

SEE LONG WAY UNDER WATER

By a system of light refraction, an Italian inventor is said to have devised a system by means of which it is possible to see 600 feet horizontally and 200 feet vertically under water. The apparatus, it is claimed, will revolutionize submarine warfare.

PHONE CALLS ARE ANSWERED BY MACHINE

For the convenience of telephone users, an instrument has been devised to take messages and answer calls received when the owner is absent. It consists of a small cabinet containing records similar to those used in dictating or talking machines. If the person is not at home when the phone rings, the instrument repeats a message to the machine, his voice being recorded on the cylinder through the telephone receiver placed over a contact hole. Messages so received are indicated on a dial. When the owner returns, a glance at the dial tells if there have been any calls. An automatic hook arrangement regulates the opening and closing of the circuit as a



Telephone and Answering Machine in Operating Position at Left; Receiver Is over Contact Hole and Hook Held by Chain. Right: Dictating a Message for Repetition

which has been dictated to it, stating that Mr. So-and-So is out and will the caller speak his message, or any other greeting the owner wishes to give. If the person speaking desires, he may give his message substitute for the usual method of lifting off the receiver. In large cities, it is believed it will save considerable expense to the companies where many "repeat" calls are necessary.

TRAVELING WELDING OUTFIT SAVES MOTORISTS' TIME

To spare motorists expense and loss of time in hauling broken cars to a garage, a London mechanic has equipped a motorcycle with welding apparatus and other tools and drives his repair shop to the automobile at the scene of the breakdown. Tanks, torches and other necessary articles are arranged compactly in this serviceable outfit.

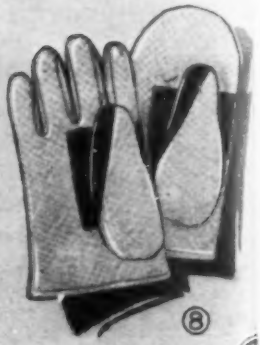
Rapid-Transit Welding Outfit on Motorcycle that Speeds to Relief of Stranded Motorists

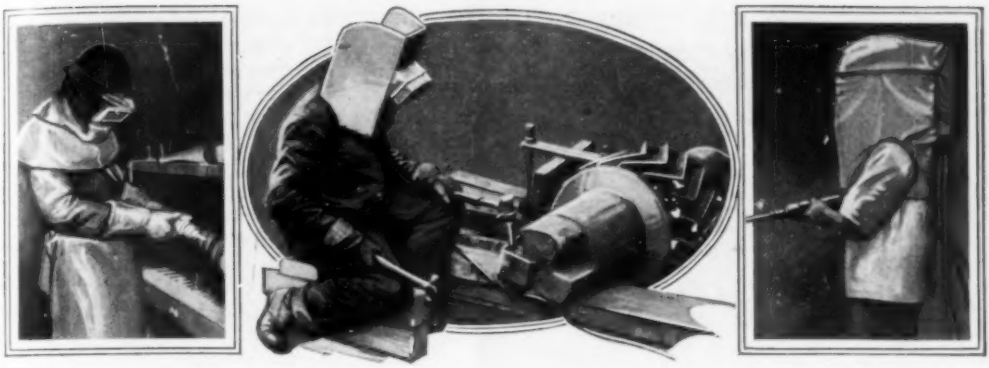
MEDICAL SERVICE BY RADIO PROVES SUCCESS AT SEA

That the service of supplying medical advice to ships at sea has proved a success is disclosed in the report of Surgeon-General H. S. Cumming. To assist the work, he has recommended that all American vessels be equipped with a standard medicine chest so that the orders of the doctor many miles away may be carried out by those on board. As conditions now are, an inadequate supply of remedies often prevents treatment that is prescribed.

SAVING WORKERS' LIVES

LIKE the steel-clad and helmeted knight of the Middle Ages, the modern industrial worker is protected by various forms of "armor" devised to save him from death and injury while he tends the many complicated machines that serve the needs of civilization. As power is the development of force, it has taken and continues to take its toll of life and limb, although new means are constantly being found to make its many applications more safe. Masks, shown in figures 2, 3, 5, and 6, guard the worker from dust and fumes. Leather hand pads, leggings, gloves, and steel-studded aprons, figures 4, 9, 8, and 7, protect his limbs; while nonslippable ladders, figure 1, prevent possibly dangerous falls.





Power's Toll of Life and Limb Cut Down

Safety Is Sought for Mankind through Science, First in Industry, Today on the Streets, and Tomorrow in the Home

By LEWIS A. DeBOIS
President, The National Safety Council

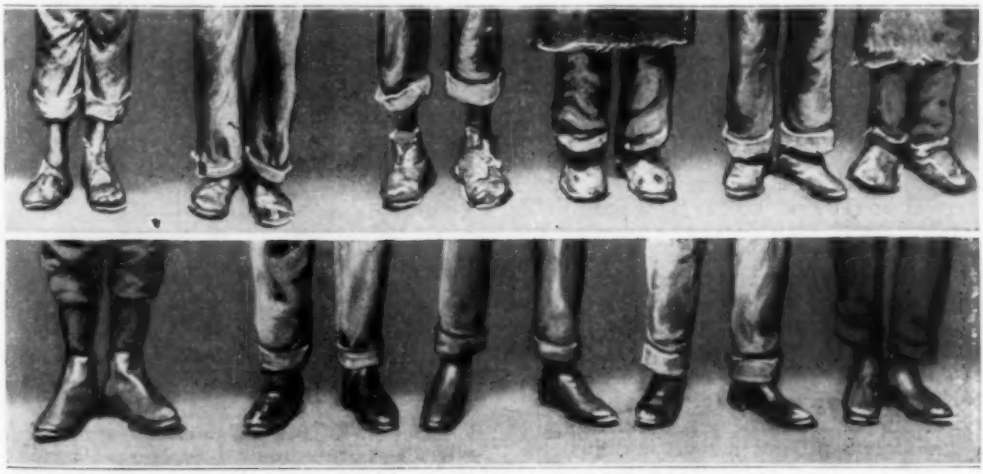
WE are today riding the crest of what is one of the most remarkable waves of moral progress that has ever swept a country.

The world has become mechanical.

"Harnessing Niagara" was an achievement. Conveying its force to great distances was an accomplishment. But to make Niagara free itself into little cubes in the millionaire's kitchen, brown the buckwheat cakes on the foreman's breakfast table, and drive the sewing machine in the third floor back, transcends any of Aladdin's mythical efforts.

Not content with harnessing mere coal deposits and rivers, man harnessed the oil fields, and with what result?—the development of cheap light and mechanical motive power enabling him to "flivver" the sea, the air, and the surface of the land until the very congestion of the highways threatens to curtail future flivver production.

See also what the gas engine is doing for the farms—the last stronghold of horsepower. The up-to-date farmer plows, reaps, threshes, harvests, milks, and goes to market by mechanical power. His wife churns, pumps, sews, and sometimes cooks with it. And, when the day's work is done,



Worn Shoes with Partially Hanging Soles that Trip the Wearer, and Dangling Laces that Catch in Machinery, Have Been Found to Be the Cause of Many Accidents

A JAPANESE SAFETY BULLETIN

AT the rise of the hand of the policeman, stop rapidly. Do not pass him or otherwise disrespect him.

When a passenger of the foot hove in sight, tootle the horn trumpet to him melodiously at first. If he still obstacle your passage, tootle him with vigor and express by word of mouth the warning, "Hi, Hi."

Beware of the wandering horse that he shall not take fright as you pass him. Do not explode the exhaust box at him. Go soothingly by, or stop by the roadside until he pass away.

Give big space to the festive dog that make sport in the roadway. Avoid entanglement of dog with your wheel spokes.

Go soothingly on the grease-mud, for there lurks the skid demon. Press the brake of the foot as you roll around the corners to save the collapse and tie-up.

by little from generation to generation. Even the individual adaptability of the chameleon to his background does not permit him to change color instantly. Human efforts at protection will always lag far behind the inception and even the conception of the hazard. It seems that an incredible number of human beings must be killed or injured before the public conscience is aroused.

It is true that a majority of industrial establishments have at last become safe places in which to work, and yet, the automobile has been allowed to take a toll of 100,000 lives in this country alone, and the annual increase in deaths has by no means been arrested. It is our human failing not to foresee these evils, and our human weakness to close our eyes to their appalling growth, until we awake to find in their elimination a huge national problem difficult of solution.

they sit together under its light and listen to music which power is broadcasting from a thousand miles away.

First, into our industrial life; next, into our public life, and finally, into our home life have crept the manifold applications of power to our daily needs. By reducing the limitations imposed upon us by space and time, they have served to broaden our minds, to increase our physical comforts, and to extend immeasurably our individual, economic usefulness.

But, because power is the application of force, it has taken, and continues to take, its toll of life and limb. The path of its application to man's needs is marked with blood—first, in the industries, some of which a decade ago were called "slaughter houses," today upon the streets, where every man's life is in jeopardy—perhaps tomorrow within the homes, its latest field of conquest.

Nature's own efforts to protect the individual of the species from the dangers of his environment are marvelous, but they are inexorably slow. Protective coloration, for example, is only developed little

CITIES PLANNED FOR MOTORS SEEN AS FUTURE NEED

Cities of the future must be planned for the motor car or there will be bedlam and confusion that will make nearly every metropolis in the country a babel of traffic congestion, according to the warning of a traffic expert recently, who declared that although automobiles are increasing in numbers at the rate of 25 per cent every year, little or nothing is being done to meet the situation. City fathers were urged to look ahead and prepare for conditions as they must be five or ten years from now. In larger cities the aerial traffic system, under which several of the prominent streets leading from the business area are made into through thoroughfares, was advocated, together with parking spaces under buildings and in subways. An entirely new grouping of business buildings, spreading them out into wider areas, was also recommended as a possible aid to the solution of the traffic problem in the larger cities of this country.

BURIED TREASURE STILL LURES ADVENTURERS TO TROPICS

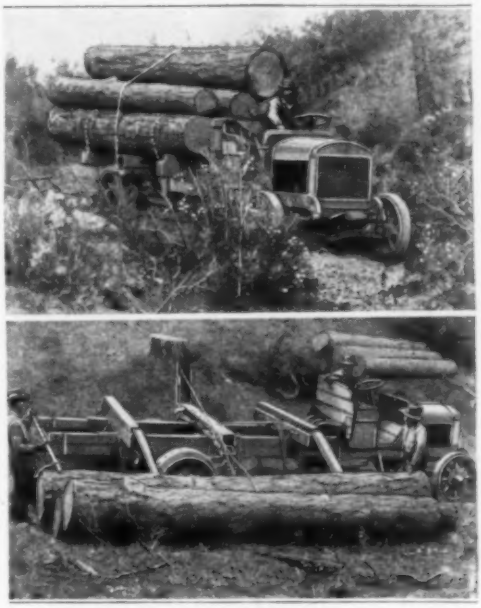
Spurred on by legends of pirate hoards in tropical seas, adventurers are still seeking gold moidores, doubloons and pieces of eight stowed in copper-bound sea chests and buried in the sands on lonely coasts or banked in bags in the holds of sunken Spanish galleons. Every now and then newspapers chronicle the setting out of such an expedition, even if the result seldom sees print. Several parties are scheduled for trips this summer. Cocos Islands, off the west shore of Costa Rica, where, legend has it, close to twelve million dollars' worth of gold, plate and gems lie hidden in the cave that has held it since it was taken from the treasure ships of Lima, is probably the best known pirate's lode. The greatest treasure trove of all, however, is that of Vigo Bay, in Spain. Here, in 1702, a fleet of seventeen Spanish plate ships, bearing $100,000,000 worth of treasure from the New World and protected by twenty-three French warships, sought shelter from an English and Dutch fleet. Pikes, cutlasses and pistols were the scheme of battle. Blazing pitch and fireballs were flung from deck to deck. Only six of the treasure ships remained after the battle, the remainder being sunk. Since that date countless efforts have been made to raise the bones of the gold armada.

DETACHABLE HANDLE FOR FILE IS SAFE AND CUTS COST

Sparing the expense of individual handles for different sizes of files, a detachable metal grip that can be slipped on or off in a second's time has been patented. It is shaped to fit the hand of the workman, cannot slip out of position when the tool is being used and does not split or break. This guards against the sharp point jabbing the user in the palm. Files without handles are more easily stored in the tool chest, so the metal grip saves space. It is inexpensive, durable and may be hung on a nail when not in use.

LOGS ARE LOADED ON TRUCKS WITH MOTOR WINCH

With the diminishing supply of lumber and the demand for more efficient methods, a winch has been invented for loading the



How Logs Are Loaded Direct'y on Motor Truck with Power Winch for Transportation to Mills

logs on motor trucks. It is operated by power from the engine and its use is said to cut down the cost of labor and eliminate the need for horses and donkey engines, which frequently are too expensive for small operations. With it the lumber can be carried directly from the woods to the mills. The loader is simple to operate, has few wearing parts and its cable may also be used in pulling the truck out of a mud hole.

HIGH-SPEED TELEGRAPH TAKES THOUSAND WORDS A MINUTE

Telegraphic messages at the rate of 1,000 words a minute have been received on a revolving, magnetic-drum instrument on display at a recent exhibit of the British Imperial College of Science and Technology. The current, passing through coils, converts a rapidly revolving iron drum into a magnet for a brief space, attracting a small piece of iron, which operates a syphon tube charged with ink. The dots and dashes are recorded on the paper tape as the drum flies past it. Wireless apparatus that could receive 300 words a minute was also displayed.

FOUR HANDS NEEDED TO GUIDE MONSTER LEAD PENCIL

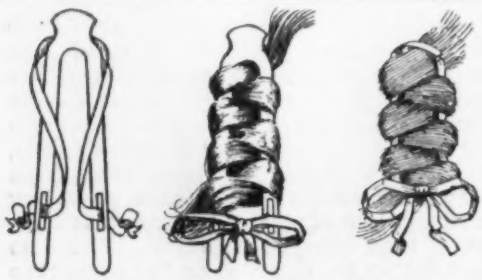
With lead, brass cap and eraser modeled after those of ordinary size, a huge pencil, the prized possession of two writers, has

Taking Notes with Exhibition Pencil—a Stunt Requiring Strength and Plenty of Room

attracted considerable comment in the literary circles of a western city. To demonstrate the efficiency of the instrument, it is necessary for one person to hold it while the other guides the ponderous point over the pages.

HAIR IS CURLED WITHOUT HEAT OR BREAKING WITH PINS

"Waves" and curls are placed in women's hair without the aid of hot irons or uncomfortable pins by using a small metal device between the two prongs of which, strands of hair are wound and coiled and then tied with ribbon or tape. The "waver" is withdrawn when one lock has been tied, and then is used again. This arrangement saves the hair from being broken with pins or burned with curling irons, and leaves no uncomfortable materials where they will scratch the scalp.



Curler with Tape Adjusted; Hair Twisted and as Tied when Prongs Are Removed

GOVERNOR FOR GAS ENGINES IS OPERATED BY VACUUM

An increase in engine power and efficiency together with smoother operation are the advantages claimed for a vacuum governor for gas engines, automobiles, trucks and tractors. It is easy to install, as it has no moving mechanical connections and requires less than two inches of space between the carburetor and intake manifold. The governor may be set at a maximum speed and sealed when a car is being used by an inexperienced driver.

ADJUSTABLE BLADES ON PLANE LENGTHEN LIFE OF MOTOR

With blades that can be turned to different angles to suit varying air conditions, an adjustable propeller for aircraft has been invented. Through a gear in the hub the pilot is enabled easily to regulate the

Adjustable Propeller with Cap Removed to Show Gear that Controls Angles of Blades

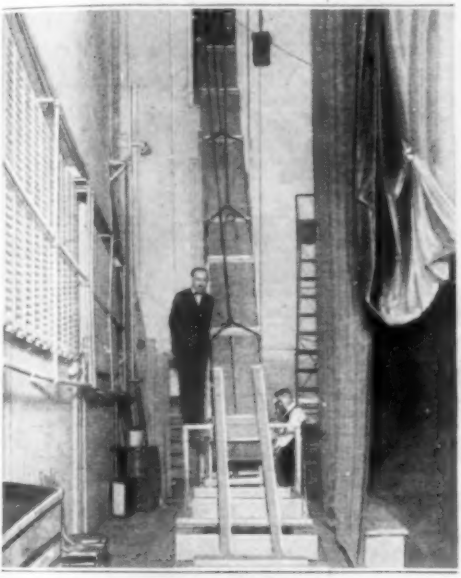
"bite" he wishes the blades to make. The inventor claims that the use of the propeller reduces the amount of fuel and oil consumption, increases the life of the motor, makes greater speed possible, and enables a machine to "hop off" from a smaller field. It can be attached to practically any style of aircraft and weighs little more than the ordinary propeller.

SPRING BELT JOINED BY BALL IS FLEXIBLE AND JARLESS

To replace bands and hooks joining the ends of spring belts, a Chicago man has invented a coupling that consists of a ball inserted in the spirals and gripped by loops of the wire. The method is said to allow greater freedom from vibration.

THUNDER FROM CANNON BALLS ADDS THRILL TO MOVIE

Twenty-pound cannon balls crashing down a long, wooden chute, and deep, roaring blasts on the huge pipes of an organ, were devices used in a New York theater to produce a realistic "background of sound" for a motion picture. In the film, flashes of lightning announced a storm on top of Mount Sinai. Timed to the second, modulated rumblings were started on the organ pipes behind the screen after the bursts of lightning. The noise increased as the storm drew nearer. To represent the grating, crashing "bombardment" at close range, the cannon balls were released at the proper moment and, as they went banging down, the sound approached that produced by nature.



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Wooden Chute down which Cannon Balls Were Rolled to Imitate Thunder on Stage

Organ Pipes that Roared Deep Base Tones During a Motion-Picture Storm Scene

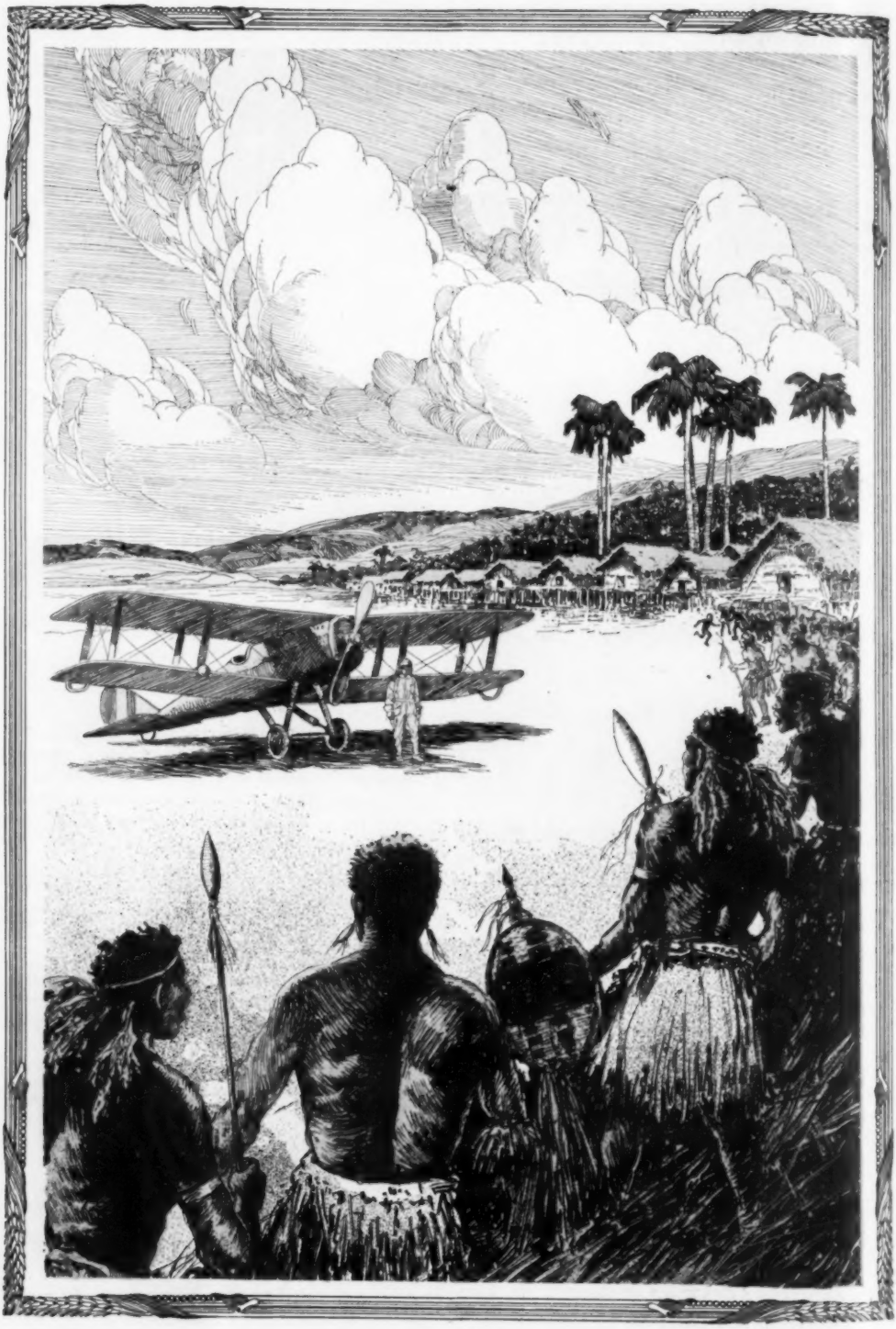
UNCLE SAM RUNS GOAT FARM TO INCREASE MILK YIELD

One of the sights of the national capital is the milch goat herd owned and tended by Uncle Sam. It was founded sixteen years ago as a scientific experiment in the breeding of scrub stock into high-grade producers of milk worth double that of cow's product. Since then the herd has been increased until now it consists of forty pure-bred Toggenburg and Saanen milch goats of all sizes and ages. The milk is used at the government diet kitchen and Georgetown university hospital for the treatment of puny infants and invalids suffering from malnutrition. Under present conditions it costs about ten cents a day to feed the lilliputian cows their regular rations of alfalfa and clover hay and their grain allowances of cracked corn, oats, bran and oil meal.

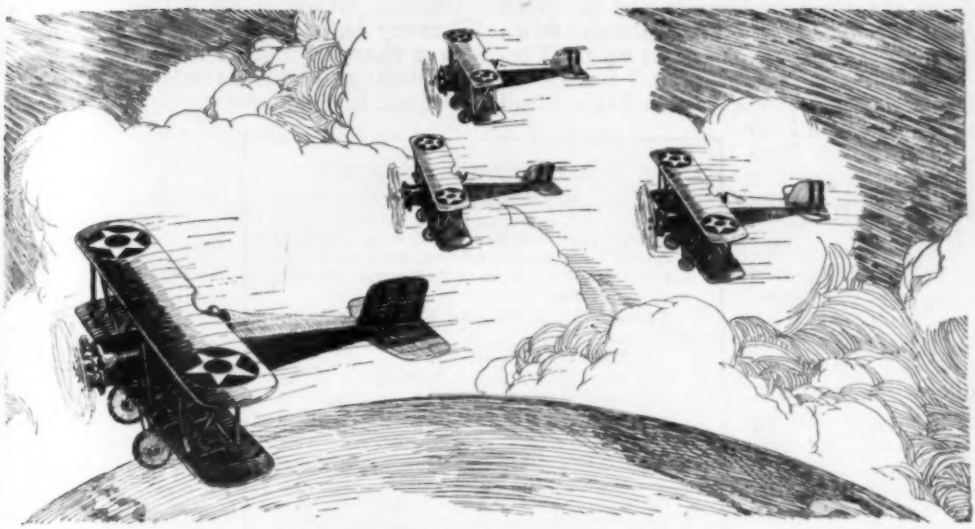
KNIFE EDGE ON FORK'S PRONGS HAS MANY KITCHEN USES

By providing the prongs of a fork with a knifelike edge, a kitchen utensil has been made which is adaptable to many uses. Because of its form, the device is of service for turning fried potatoes, mixing batter, crushing stewed fruit, chopping onions, removing articles from hot water, cleaning pastry boards and for many other things. It is constructed of strong metal, plated and highly polished.

Knife Edge on Prongs of Fork that Adapts It to Many Kitchen Needs



One of the Hazards of a Round-the-World Flight, an Aviator Forced Down in East Africa and Surrounded by Hostile Natives; the Pilot Escaped, Leaving His Plane Behind



Perils Faced in Around-World Flight

Army Fliers to Cross Twenty-Two Countries in Journey that Will Cover Thirty-Nine Thousand Miles

UNDER the imaginative pen of Jules Verne, Phineas Fogg went entirely around the world in eighty days, using boats, trains, elephants and even a sail-equipped sled. On the home stretch he burned the furnishings of his ship for fuel. But these difficulties pale into insignificance when compared with the hazards of the feat proposed by the United States army—a round-the-world flight by a fleet of airplanes, American designed and built throughout. "The United States," said Maj. Gen. Mason E. Patrick, chief of the air service, "has the distinction of holding every air record of value, including speed, altitude, endurance and distance, and now has conceived a project rivaling in importance the circumnavigation of the globe by Magellan. The four planes to make this flight will demonstrate the feasibility with which aerial communication may be established between continents. Much valuable information will also be obtained concerning the operation of the present type of aircraft in the various climates of the world." Starting from San Diego, Calif., the aviators will fly direct to Seattle, where they will hop off on the first leg of the approximately

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Army Fliers at Langley Field, Virginia, Studying Route to Be Covered in Around-the-World Flight

39,000-mile voyage over the air lanes of twenty-two countries. Roaring northward along the coast of Canada and southern Alaska; across the Aleutian islands; down through Japan; across India; up the Persian gulf; across Turkey and Europe to England; thence to Iceland and Greenland and southward to the Canadian border, it is hoped the planes will escape the rainy season in the United States and India and will complete the journey by August or September. The four American planes will be all metal, have a wing spread of fifty feet, a speed of 175 miles an hour and a radius of 2,500 miles. They will carry 800 gallons of gasoline, fifty gallons of oil and be able to stay aloft twenty hours. The longest continuous flight necessary on the voyage will be from Attu to the Kurile islands, a distance of 700 miles. Other long hops will be required over the Atlantic ocean between the Faroe islands and Iceland and Greenland, and between Greenland and northern Canada. It is expected that, before the journey is completed, each airplane will have changed motors three times.

Climatic conditions will be one of the greatest hazards encountered and a glance at the proposed itinerary indicates what may be expected. From the arctic weather of Greenland and Iceland to the deserts of Arabia and Asia Minor is a long jump, climatically speaking, and one that will offer no end of difficulty. Favorable landing fields are few and far between. From the northern boundary of the United States to Nome, there lies about 2,000 lineal miles of the most repelling country that could be crowded together anywhere on the face of the globe. Deep canyons, mighty glaciers, timber-covered mountain ranges and snow-topped peaks form a terrain of marvelous beauty, but one which evokes no cry of admiration from a bewildered

SLANG OF THE AIRWAYS

MIRRORING the romance, tragedy and adventure surrounding the conquest of the air, countless words and phrases, forming a strange language distinctive to aviation, have come into use among pilots. Some of these terms and their meanings follow:

CRATE OR SHIP—An airplane or hydro-airplane.

STICK—Control lever.

SIT DOWN—To make a landing.

CRACKED—Plane wrecked in landing.

BOTTLE OF MILK—Fog or snow-filled atmosphere.

BLINKERS—Intermittent guiding lights placed on the ground.

CEILING—Highest point under the clouds at which earth is visible or the maximum height to which the plane can ascend.

Copyright, Hamilton Maxwell

Oxford University in England Which American Aviators May Visit on Return Journey

pilot looking down for some possible spot to set his "crate."

A "milk-bottle" atmosphere, however, is probably the greatest danger the fliers will face. It contains frost and fog which blot everything from sight except the nose of the plane, the tail and each wing tip. The Venturi tube of the air-speed indicator becomes frosted inside, and, therefore, does not give a correct dial reading. Flying through snow is easier than flying through rain. Although safety always lies in height in the air, in flying over strange country every pilot strives to keep within sight of the ground, or under the cloud "ceiling." If he goes above the clouds, he often loses all sense of direction. Also, having risen above the clouds, it is necessary to come down through them, and as the mist may be clinging to the ground or mountainside, a "crash" results before the pilot realizes his position. Although comparatively little data has been gathered as to weather conditions in the tropics, the only unexplored airway that the round-the-world fliers will encounter is between the Pacific ocean and the South China sea. What is known as the "Typhoon Triangle" has the China sea, Manila and Hongkong for its points. It is hoped, however, that by seeking an elevation of from one to two miles, the aviators will be able to ride above any such disturbances. Between India and Damascus the pilots will use the air-

Copyright, Fairchild Aerial View

Air View of New York City over Which the Army Fliers Will Pass on Last Leg of Flight

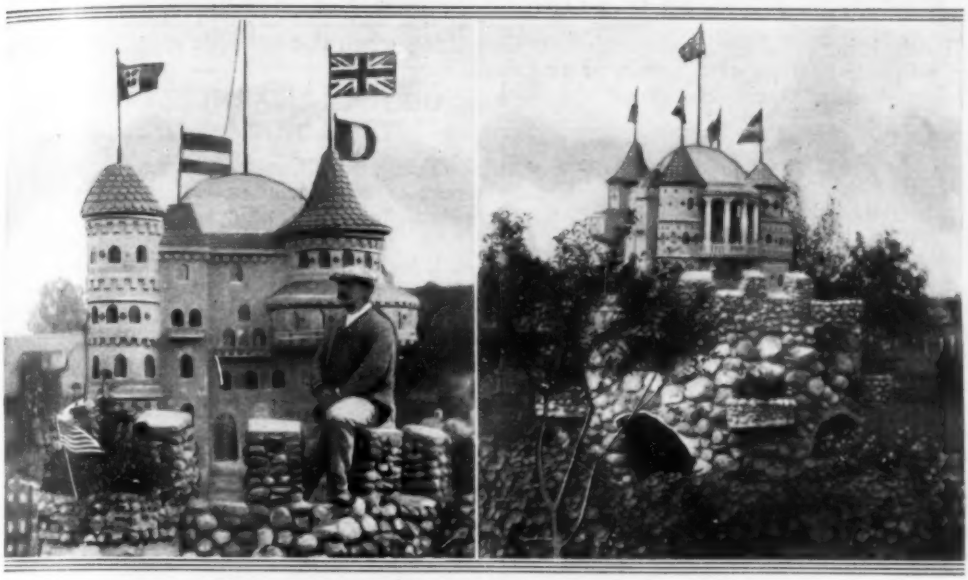
way established by the British to assist in keeping in close touch with their far-flung empire. This does not mean that the country from the azure Indian ocean to Europe's smooth fields is conducive to free and easy flying, however. Impenetrable jungles, rock-scarred mountains, a jagged coast line and sun-beaten deserts, the shifting sands of which are infrequently trod by the clumsy feet of camels traveling in caravan, offer nothing but danger and perilous solitude to winged strangers. Crossing Europe should entail no great hardship after the problems of Asia have been solved. Scandinavia will be the jumping-off place and there three long over-water flights will face the pilots—Norway to Iceland to Greenland to northern Canada. No doubt, extensive overhauls and repairs will be made before the dash for America is started, for to flounder into the frigid waters of the Arctic sea after covering every conceivable kind of territory would be a tragic climax not to be risked at a critical stage of the journey.

Map of Proposed Around-the-World Flight of Four Planes

Regardless of the outcome of the attempt, it is bound to mark a new epoch in the conquest of the air by man. It was only a few years ago that the entire world was interested in the attempt of British aviators to fly across the Atlantic. Newspapers were filled with stories of the successful flight across the Atlantic of the United States navy's NC-4, which was hailed as the acme of aviation achievement. Ten years ago, almost to a day, the British channel was crossed by an airplane piloted by Louis Bleriot for the first time to win a coveted prize put up by a great newspaper. The barking challenge from Bleriot's tiny, twenty-two horsepower motor was taken up and the answer came a decade later in the spanning of the Atlantic, the non-stop record flight of Lieutenants Kelly and MacReady, of the United States army, from New York to San Diego and the achievement of Lieut. Williams, U. S. N., in roaring through space at a rate of speed hitherto unknown in the checkered history of transportation. In 1915, a round-the-world flight was proposed as part of the Panama-Pacific Exposition, but scientists then deemed it "impossible of accomplishment in this generation." Many years previously, Benjamin Franklin, when asked his opinion of a balloon ascension in France, wisely replied: "Of what use is a new born babe?" And so, if the present attempt to circle the globe succeeds, America surely will have every right to her champions, for it was their progenitors who timidly tested the same winds, ventured aloft on the same air currents and crashed on the same soil—the Wrights, Curtiss, Langley, Chanute and a host of others.

America, however, will not achieve the honor of being the first to circumnavigate the earth without a battle, for both Great Britain and Portugal have been preparing for months for similar attempts. The latter country will use Fokker monoplanes with a wingspread of about sixty-five feet and a capacity for carrying a useful load of 3,000 pounds at a speed of 110 miles an hour. Several previous attempts to encircle the earth have been made by the British and French, but without success. Supplies for the army fliers will be shipped from the United States to various points on the route and pathfinders will cover each section of the flight. For flights over the ocean, planes will use pontoons.

MINIATURE CASTLE IS BUILT IN GARDEN NOOK



Model of Ancient Castle that Required Two Years to Build

Exactly duplicating in every detail a structure built 600 years ago, a miniature castle, with balconies, columns, a tile roof, hanging baskets filled with flowers, and an observatory on the top with winding stone steps, has been constructed by an Illinois man. At the base a terrace provides space for flowers and shrubbery. There are four floors, each with different art-glass lights and more than a hundred windows, all of which were cut by hand. The walls are studded throughout with cut-glass jewels. The ceilings are made of solid mirrors, and a complete lighting system has been installed. Throwing light on the jewels, cut glass, and mirrors produces unusual effects which make the "castle" a thing of beauty at night. That his reproduction might be complete in every detail, the builder used twenty-seven loads of rock, thirty-two bags of cement, and seven carts of gravel for the base.

KITCHEN SPOON STRAINS EGGS THROUGH SLOTTED BOWL

Separating egg yolks from the white without breaking them is easily done with the aid of a large spoon which has a wide, slotted bowl to allow the white to slip through into a dish below. The opening is too small to permit the yolk to pass, and its shape and rounded edges aid in preventing the egg center from bursting. The spoon is also useful for whipping potatoes and cake batter, and for straining vegetables from soup.

Straining Off the White of an Egg Through the Slot in Spoon's Bowl

SCARLET FROG WITH BIG VOICE FOUND IN TROPIC JUNGLE

Emitting a croak of great volume, a bright red frog has been found in the jungles of British Guiana by scientists from the New York Zoological Society. The scarlet animal, it is reported, is regarded as a charm by some tropical natives. When one is caught, it is cut into as many pieces as there are warriors in the village. Each man then rubs his portion over the points of his arrows in the belief that this practice will assure his weapon perfect aim.

MILK SEPARATED FROM CREAM THROUGH HOLE IN BOTTLE

By draining off the milk through a small hole in the bottom of a bottle of recent design, undiluted cream can be obtained

Letting the Milk through Hole in Bottom and Pouring out the Unmixed Cream

easily, saving the housewife the trouble of pouring the milk into pans and skimming it. The cap does not have to be removed when this bottle is used, thus keeping the cream tightly sealed from impurities until wanted. The small orifice is designed so that it does not come in contact with anything when the bottle is standing upright.

GROWING VARNISH ON TREES IS FLORIDA INDUSTRY

Tung, or China-wood oil, a very important raw material in the manufacture of varnishes, wall paints and enamels and largely used by the linoleum and printing-ink industries, is now being produced in Florida. After much experimentation, it has been found that soil, temperature and climate conditions are favorable to the growth of tung trees on hundreds of thousands of acres of idle land in the south. The quality of the oil pressed from the nuts of these trees in America is said to be higher than the Chinese obtain.

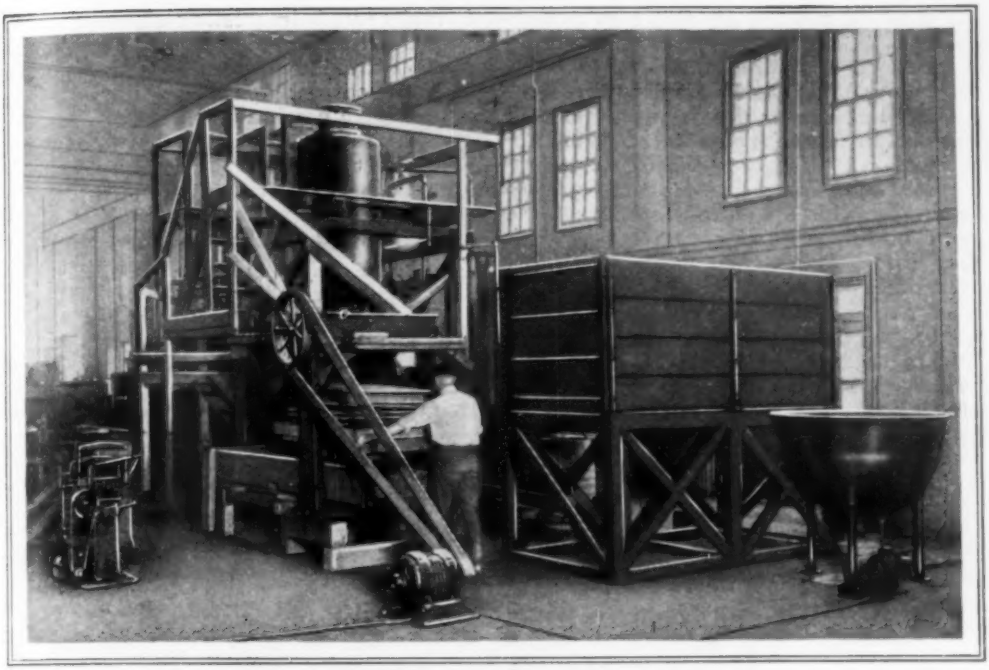
VALUABLE SILK SPUN BY FISH

Fish that spin silk are said to have been found in the warm waters of the Mediterranean sea. Known as "puina," they have tongues shaped like tubes enabling them to form threads similar to those made by spiders. So fine is the strand that six miles of it is said to weigh no more than a grain. Stockings and other light fabrics woven from the material are declared to possess great warmth and durability, but are very expensive. The fish changes its place of abode frequently, leaving behind each time, a hammocklike bed of the silk.

ELEPHANTS' FEET ARE TURNED INTO USEFUL JARS

Waste-paper baskets, tobacco jars and receptacles for various uses made out of elephants' feet have appeared in German shops. Equipped with hinged covers, tightly lined interiors and with bands of polished metal about the top, these novelties are attractive in appearance and their stability and durability are said to appeal to the purchaser seeking "something different" in the way of a useful curio.

Elephants' Feet Pressed into Further Service as Decorative and Durable Holders for Tobacco, Waste Paper and Other Articles



Changing Lowly Corncobs into Valuable By-Products

How Uncle Sam Is Turning Waste Into Gold

WHILE the public is clamoring for reduced taxes, cheaper coal, and a drop in the cost of living, Uncle Sam is steadily transmuting waste into gold to make some of these dreams come true through the elimination of waste. In an effort to discover practical and economical methods by which to convert great masses of apparently useless material into profit producers, a staff of scientific wizards has been set to work by the government.

Out of this campaign has emerged the lowly corncob with a place in the sun and no longer condemned to be burnt, dumped into swamps and rivers or buried. As though touched by a magician's wand, it has come forth as furfural, a brand new combination, to vie with bakelite and having a whole retinue of places of usefulness and a rising commercial popularity.

Under the same influence the misfits, defectives, misshapen and overgrown members of the citrus family and the humble sweet potato have also arisen from their Cinderella roles to take their places as valuable products, and the very deficiencies that shut them out from market association with the balance of their crop have operated to their new development.

One of the big problems in farming is the practical utilization of all of

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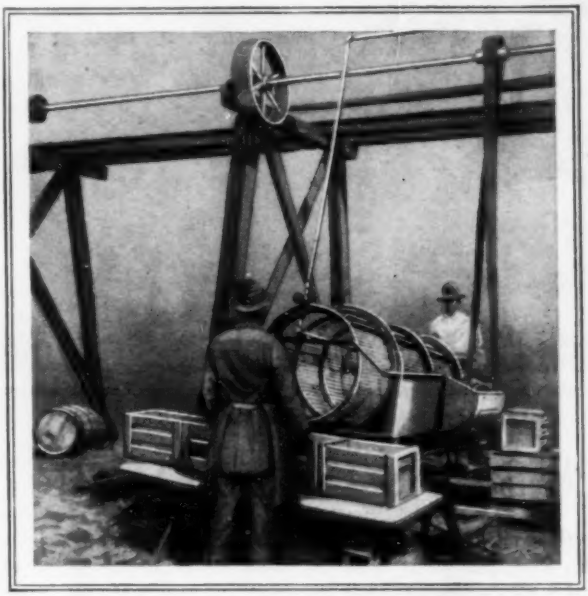
Government Expert Testing Purity of Green Tea

the seconds, culls or surplus of a perishable nature, and at present close attention is being given to this question. For instance, the orange and lemon growers have until the last half dozen years suffered material losses in the waste of quantities of fruit too large, too small, slightly defective in shape, or bruised from careless handling. This amounted to about three per cent of the total crop from year to year. The establishment of a laboratory in Los Angeles, in 1914, had for its objective the development of new products from this waste crop. Since its opening, the production of by-products from the leftovers has been greatly helped. Four concerns in this field now have a capacity of 50,000 pounds of lemon oil, 500,000 pounds of citrate of lime, and more than 1,500,000 pounds of citric acid annually. The same impetus livened up the orange by-product plants and now there are twenty of these engaged in producing orange marmalades, jellies, juice, and the candied peel, to the tune of six million pounds each year. Better methods have inoculated the orange vinegar production, and the grapefruit has not been overlooked, as improved fruit juices, conserved and canned products and candied peel being so successfully sold, bear witness.



Washing Sweet Potatoes as One Step in the Process Perfected by the Government for Turning Them into Sirup

With his eagle eye upon another source of loss, Uncle Sam recently organized an experimental laboratory at Fitzgerald, Ga., to find out what could be done with the great mass of unmarketable sweet potatoes lost by decay each year. The result was the discovery that a good sweet sirup could readily be made from these "spuds." Though this is not so sweet as cane or honey, it is practical for table use, cooking and for making certain kinds of candy as caramels, taffy and kisses.

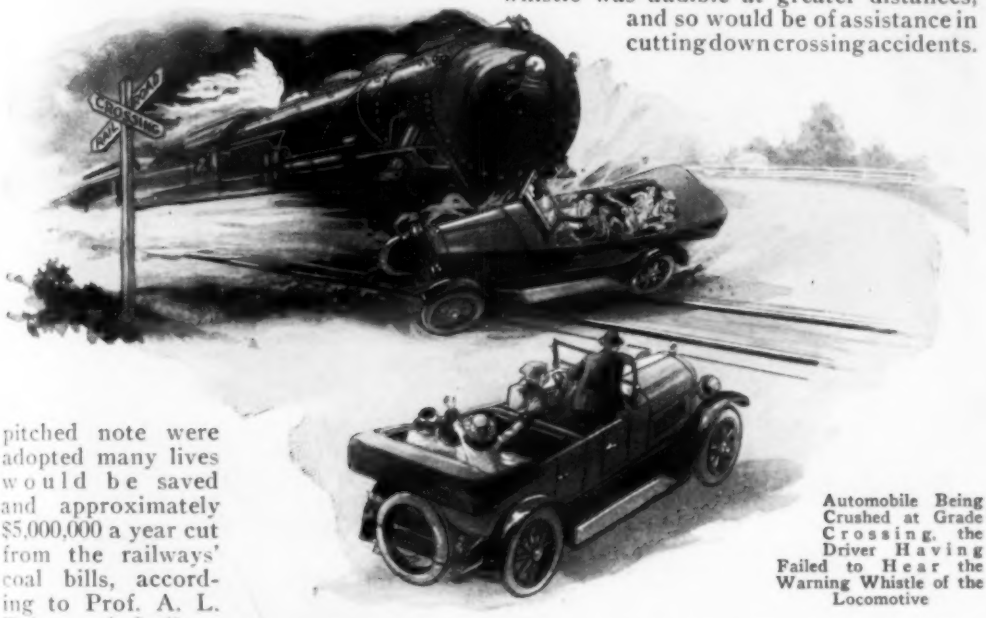
The debut of the corncob in chemistry is replete with interesting discoveries. It is estimated that about twenty million tons are produced each year, of which practically the entire amount has gone to waste save a small portion used as fuel, in which case it is rated at about one-third the value of coal. Experts of the bureau of chemistry reduced it to a soluble mass from which all of its valuable substances could be extracted and every element analyzed and tested. An experimental laboratory was set up in Virginia, and the first result obtained was a process for adhesive. The discovery of furfural came about through experimenting with sulphuric acid upon the adhesive material. Up to this time, less than two years ago, the lowest price quoted by chemical supply firms was $30 per pound for furfural, but soon one firm got it down to fifty cents per pound in one-hundred-pound lots. But from the data obtained from the laboratory it was shown that a yield of six per cent, or 120 pounds of furfural per ton of corncobs could be obtained.

Now furfural bids fair to be of value in the making of resins similar to bakelite and suitable for the construction of electrical instrument parts, printing plates, talking-machine records, and molded articles.

In the prevention of dust explosions, the government also has rendered valuable aid to the industries of the country. Plant dusts are highly explosive and when mixed with air in certain proportions they only need a spark to produce violent and disastrous blasts that have caused great loss of property and life. As a result of experiments, such explosions in the far northwest among grain mills, starch factories, and elevators have been greatly reduced, the number being brought down from 300, with a consequent loss of $1,000,000, to less than sixty.

WHISTLE IN FRONT OF LOCOMOTIVE TO SAVE LIVES

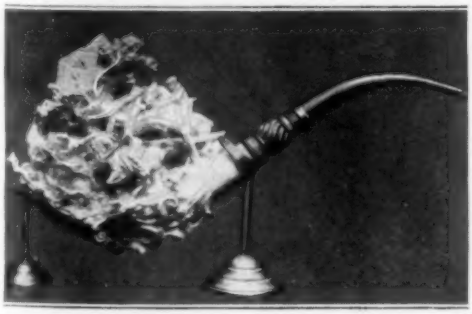
If locomotive whistles were placed in more forward positions and a single, high-pitched note were adopted many lives would be saved and approximately $5,000,000 a year cut from the railways' coal bills, according to Prof. A. L. Foley, of Indiana university. After recent tests, he declared that the sirens now are not placed to the best advantage, being behind the smokestack and steam dome. When in front of the boiler, it was found that the whistle was audible at greater distances, and so would be of assistance in cutting down crossing accidents. As they would be more easily heard, the whistles, it was said, would be needed less frequently, resulting in a saving of fuel.



Automobile Being Crushed at Grade Crossing, the Driver Having Failed to Hear the Warning Whistle of the Locomotive

TWO YEARS SPENT IN CARVING MEERSCHAUM-PIPE DESIGN

Although it has never been smoked, a meerschaum pipe is valued at several thousand dollars by its owner for the carving that adorns the bowl. It is the work of an Italian sculptor who spent two years on the task. The design depicts three mounted horsemen and seven hunting dogs pursuing a fleeing stag. A richly carved border and the delicately outlined branches of a tree beside the fragment of a ruined castle wall, forming the top of the bowl, are included in the design.



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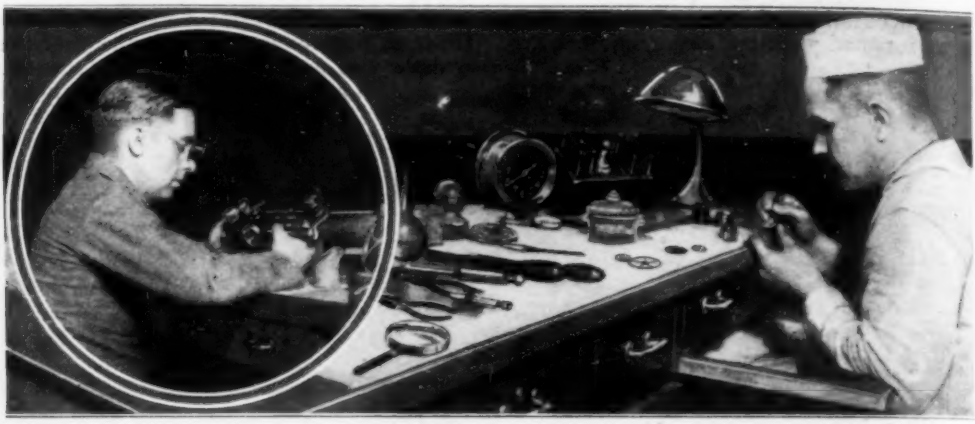
Carved Meerschaum Pipe Valued at Thousands of Dollars for Sculpture on Its Bowl

GOLD FROM WATER OF THE SEA STILL ONLY A BUBBLE

Making gold from sea water, or, more accurately, extracting the vast amount of precious metal in solution in the oceans is still only a dream. Some time ago a rumor was circulated that a profitable method of doing this had been invented in Germany. Investigation proved, however, that the report was founded on the researches of an industrial plant on the shores of the Adriatic which found that the average amount of gold in sea water was one ounce to 31,000 tons of water. Furthermore, it was shown that the gold was not in simple solution, but in what is known as the "colloidal" state, making its isolation much more intricate.

"FACTORY" SHIP KEEPS WARCRAFT IN REPAIR

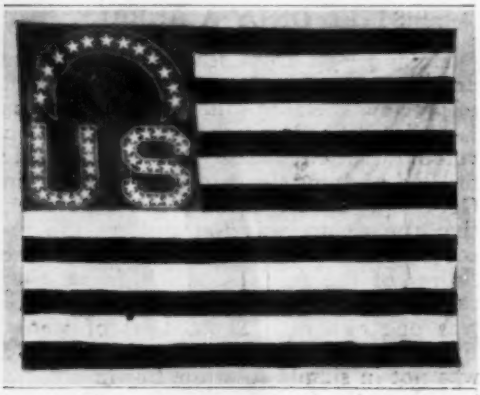


One of the Navy's Watchmakers Plying His Trade Aboard the U. S. S. "Bridgeport," Mending Timepieces for Crews and Craft. Left, Inspecting Range Finder Repaired on the "Factory" Ship

Warships of the Atlantic fleet that get out of order during maneuvers far from a shipyard, are attended by the repair crew of the "Bridgeport," a vessel equipped to mend almost any damage occurring to the craft in ordinary action. Skilled workers turn out parts of machinery to replace those injured or worn out in practice operations, or while on long cruises. Broken shafts or beams are welded by oxyacetylene and the crippled boat is ready to resume activity within a few hours after such accidents. Watchmakers and instrument repairmen may be seen below decks of the "factory" ship putting the timepieces of the fleet in order and adjusting range finders and gun sights frequently jarred out of commission in the "war game." In cases of extreme necessity, the foundry of the repair craft can produce large castings with a speed equal to that of the most up-to-date shore establishment, thus permitting a battleship to be out of service for only a short period. While the fleet is on trips far from its base the floating industrial plant accompanies it.

CHANGE IN DESIGN OF THE FLAG PROPOSED TO ARMY CHIEFS

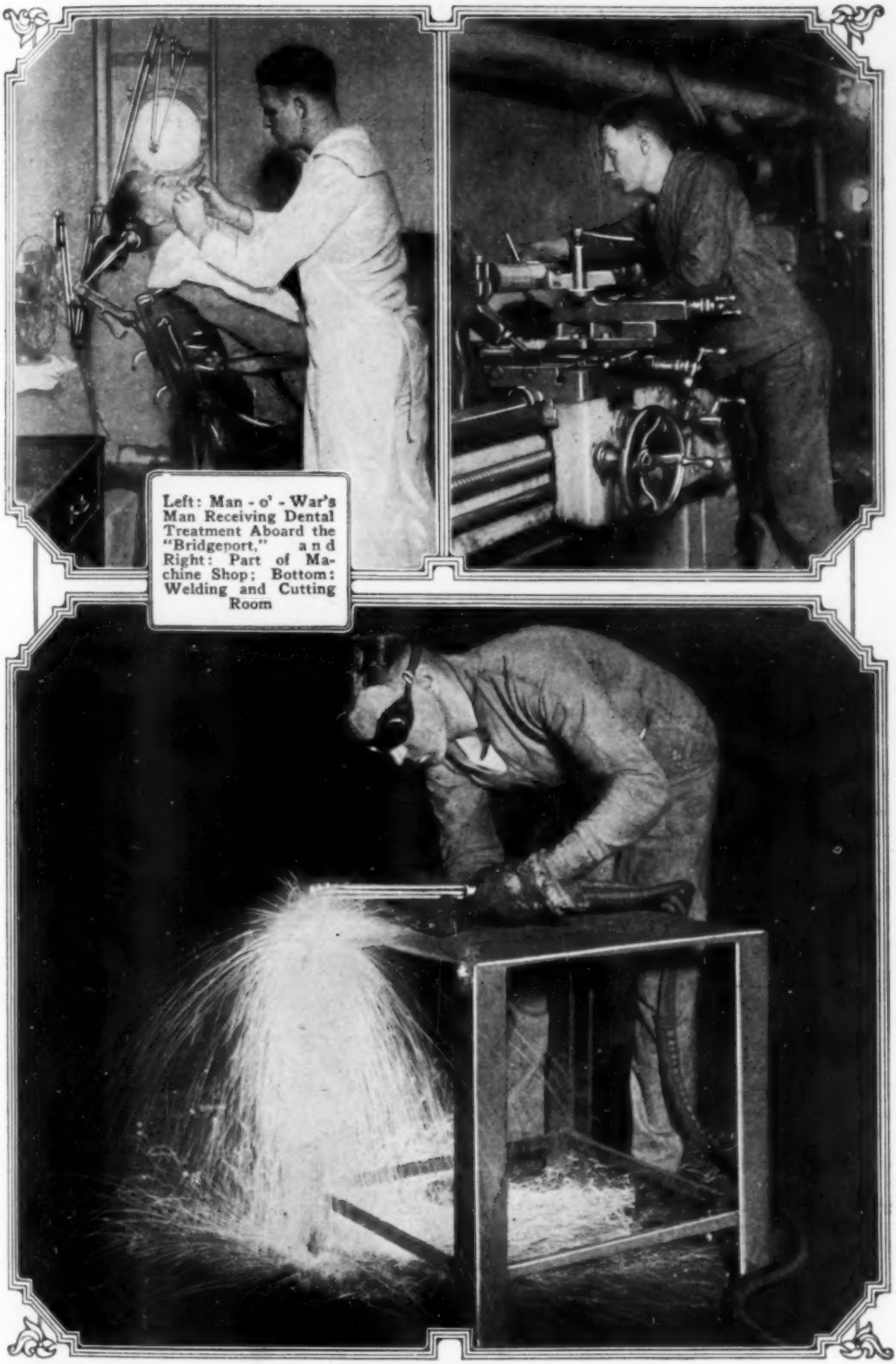
Novel arrangement of the stars is proposed in a United States flag of unique design which has been submitted to the war department. Stars representing the thirteen original colonies are grouped in a crescent above the letters "U. S." formed from the remaining thirty-five. There is no change in the arrangement or color of the stripes or of the field. The originator of the pattern, a former school-teacher, is said to have chosen this particular design so that the national emblem would be identified more easily by foreigners.



American Flag with Letters of Stars as Former School-Teacher Would Have It

RADIO BEACON GUIDES AVIATOR ON HUNDRED-MILE FLIGHT

Guided only by signals spoken over a radio beacon, an aviator recently flew from Dayton, Ohio, to a point one hundred miles distant, arriving there without mishap and without losing his course at any point. In his receiver he heard the letters A and T (·— —) repeated over and over. As he flew along the correct course, both letters were equally loud, but the moment he got off the course to one side or the other, one letter became noticeably louder than the other and showed him which way to turn to get back.



Left: Man-o'-War's Man Receiving Dental Treatment Aboard the "Bridgeport," and Right: Part of Machine Shop; Bottom: Welding and Cutting Room

FLIGHT OF GULLS IS PICTURED IN SCULPTOR'S CLAY

Swooping in realistic fashion over a breaking wave, figures of sea gulls form the chief motif in the design submitted for

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Navy Memorial Design; Gulls Modeled so that They Seem to Be Poised Unsupported

the proposed Navy memorial which is to be erected in Washington, D. C. By careful balancing of the pieces, distributing the weight of the material and interlacing the wings of the birds, the gulls stand out in full relief to increase the suggestion of graceful flight. Although the design is said to have been accepted by a committee, a New York sculptor has objected to it on the ground that gulls are scavengers of the sea and therefore should not be used to symbolize the United States navy.

TOBACCO PURSUED BY FOES IS HARD CROP TO HANDLE

When a man walks into a cigar store to buy something to smoke he little realizes the processes gone through by the bit of tobacco he gets. At least two years have elapsed between the time that the seed is planted and the day that it is ready to go up in smoke. The hazards that attend its career from seedling to the familiar blue haze are more numerous and diverse than those affecting almost anything else raised on an American farm. A half dozen varieties of bug and worm, several diseases and many kinds of weather ruin a crop overnight. Usually the seed is sown in April in beds covered with glass or cloth. These have to be heavily fertilized and frequently watered and cared for. During the last part of May the plants are transplanted in the field where they must be kept absolutely free from weeds throughout the season. August and early September are devoted to the harvest, as the tobacco must be cut before the frost. Then the plants are hung up in the barns where they go through a curing process until November. Later the leaves are stripped off and packed in heavy bales. The next step in the process is grading. In the Connecticut valley the tobacco is sorted into at least ten grades. Following this it is packed in boxes for sweating or "fore-sweating," again graded according to quality, yield, texture and "burn" and shown to the prospective customer.

RIVER MUD CHEAP DYE SOURCE

By a process reported to have been discovered in England, river mud may be manufactured into dyes with which papers and lightweight fabrics can be colored. After the mass is dredged from the streams, small stones and grit are removed and the material is dried and ground before being burnt in furnaces. Excess gases are driven off and pass through a "scrubber" that is said to drain out any ammonia. While being baked the mud turns to a deep brown shade.

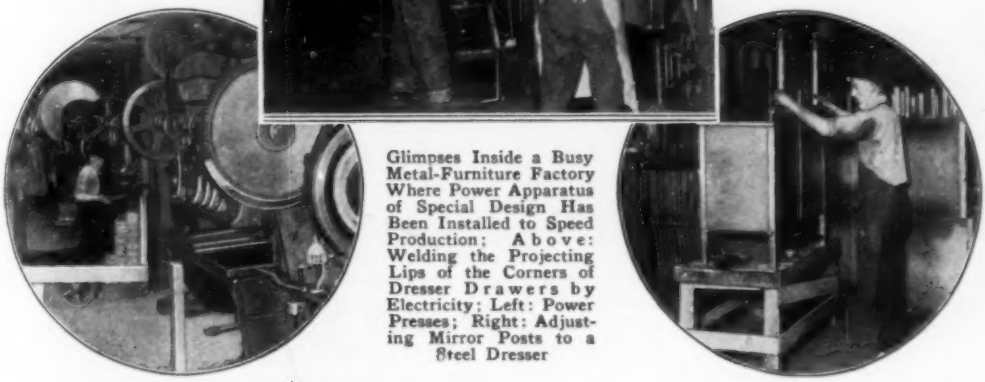
KEYLESS LOCK ON GEAR-SHIFT LEVER BALKS AUTO THIEF

Designed to fit any standard gear-shift lever, a combination automobile lock has been patented. It eliminates the annoyance of using keys, which is of special value in cold weather. The tumblers operate easily and are said to be soundless, thus preventing the opening of the lock by "feeling" the combination. It does not interfere with driving.

Building Beauty Into Steel Furniture

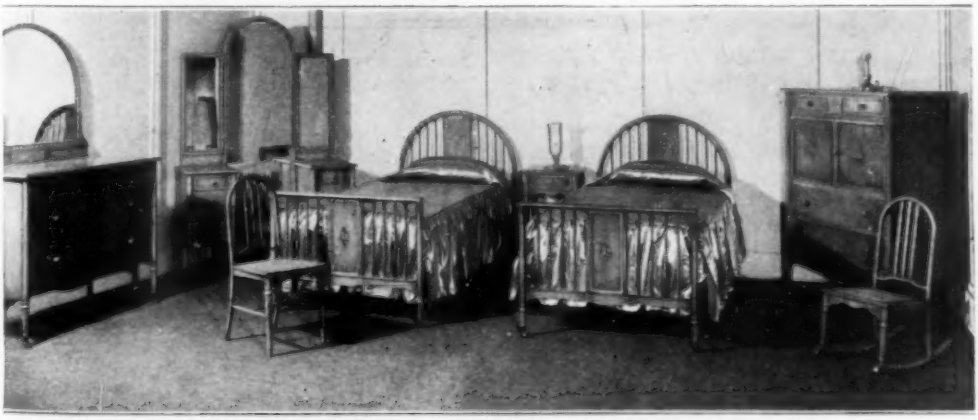
Combining Durability and Utility in Metal Marks Another Milestone in Progress of One of Nation's Youngest Industries

MARKING a significant development in the iron and steel industry, one of America's youngest arts, the manufacture of metal furniture on a broad production basis promises to solve the problem of the shortage of hardwoods and open a way for new economy to householders. Office equipment, beds and other articles of metal have been on the market for some time. In fact, bronze thrones, tables and couches, inlaid with ivory and lavishly decorated, were known in ancient Nineveh, to the Assyrian kings a century before Christ and to the Romans. But now, complete bedroom suites and other articles are being made at the rate of hundreds each day, in factories that vibrate to the movements of special machinery designed for the sole purpose of transforming steel into new ways for the service of man. One Wisconsin company is now turning out more than 300 pieces of bedroom furniture daily, the product including nine distinct suites each consisting of ten or eleven separate pieces.

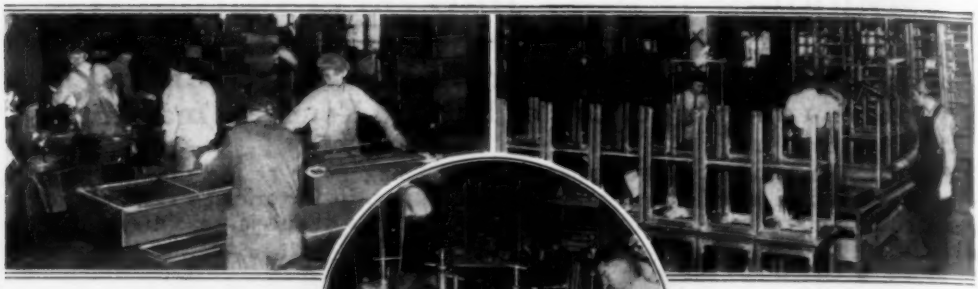


Glimpses Inside a Busy Metal-Furniture Factory Where Power Apparatus of Special Design Has Been Installed to Speed Production; Above: Welding the Projecting Lips of the Corners of Dresser Drawers by Electricity; Left: Power Presses; Right: Adjusting Mirror Posts to a Steel Dresser

Production on such a large scale has been made practical because of the discovery of ways to apply a durable and artistic finish to the metal and because efficient power presses and other necessary



Steel Bedroom Suite of Graceful Design and Finish Rivaling that of Finest Woods



Left: Completing Dresser Drawers; Right: Inspecting Tables; Below: Brazing Joints

machines have been invented. After many experiments, pieces of steel tubing and flat sheets of metal are now transformed into tables, chiffoniers and other articles of design and finish that the eye of an expert can hardly distinguish from the most costly hardwoods. The materials used are principally cold-finished sheets and cold-rolled strip steel. About 750 pounds of the metal are needed for making a bedroom suite exclusive of the bed. All framework is constructed of seamless tubing electrically welded. This is made first, grooves being left in the corner posts for inserting the flat sheets that form the tops, sides and backs. Dresser tops are left so that they can be slipped out if there is need of replacing them and they are also "deadened" to prevent metallic sounds. Legs are bolted into the framework, thus insuring great stability. In every one of the 280 separate operations in constructing a dresser, for instance, from the time that the tubing comes from the mill until it is ready for painting or enameling, parts are assembled accurately within one-thirty-second of an inch to attain perfect fit.

In giving the metal its finish, a priming coat of solid color is applied first. Then, skilled workers brush on a coarse grain. This is followed by a second coat of darker hue and then a fine grain. Both graining operations are done free-hand to avoid a stenciled appearance. One, two or three coats of varnish are applied and after each coat, the furniture is placed on small tray cars and run into ovens where it is baked one hour at a temperature of 300 degrees Fahrenheit. Herein lies one great advantage over wood, for the metal can be heated to a high temperature to insure a durable finish that will not easily become scratched or marred and will resist a forgotten cigar or cigarette stub.

Brazed, welded and bolted together, the metal parts form a rigid article. A spindle-legged dressing table is said to stand ten times as much weight as one of wood. Dresser drawers that do not stick in damp weather, legs that cannot be split by caster spindles, mirror more securely fitted, greater cleanliness and protection from fire are a few points claimed for metal furniture in addition to its beauty.

ARMY DOES MORE THAN FIGHT; HAS MANY PEACE DUTIES

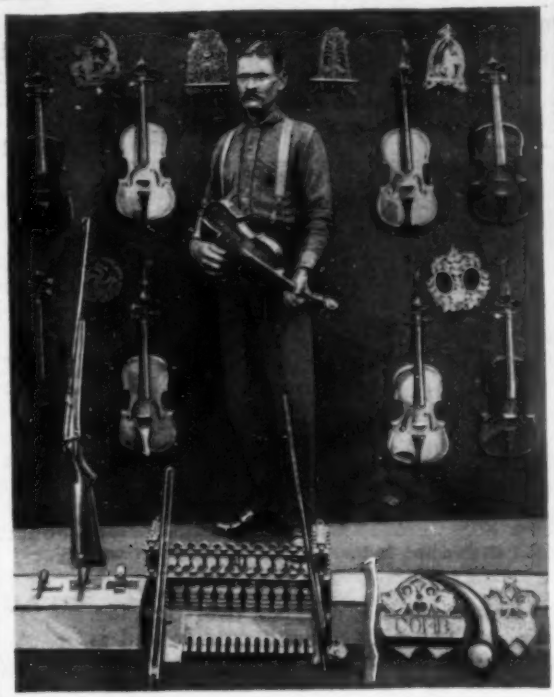
Besides its training for war service, the United States army serves a long list of nonmilitary purposes. It is a sort of university for training in social service; its engineers make rivers navigable, extend telegraph service into the wilderness, build roads, improve harbors, erect lighthouses, explore the Arctic area, and its physicians make the tropics habitable. The medical corps has played a leading part in eradicating hookworm, typhoid and establishing effective public sanitation. The chemical service has to its credit numerous contributions to medical science, including effective means for destroying farm pests and undesirable insects. The ordnance department has contributed greatly to the science of metals and has helped in standardizing motor transport.

TOBACCO HAS RIVAL IN WEED

Watercress is said to have been found by an English inventor to be as pleasant to smoke as tobacco and, when used as stuffing for pillows, can be employed to induce sleep to sufferers from insomnia. Other medicinal qualities reported to exist in the once "worthless weed" have made it so valuable that its culture has been taken up extensively in Germany.

WHITTLER'S SKILL RIVALS ART OF ORIENTAL CRAFTSMEN

With a penknife as his only tool, a Pennsylvania man is reported to have carved wooden ornaments that vie with those produced by skilled craftsmen of the orient in beauty and detail. Almost any article that can be cut from a piece of lumber can be created by the whittling sculptor, it is claimed. Among his many achievements are violins, scrolls, and even a powder horn.

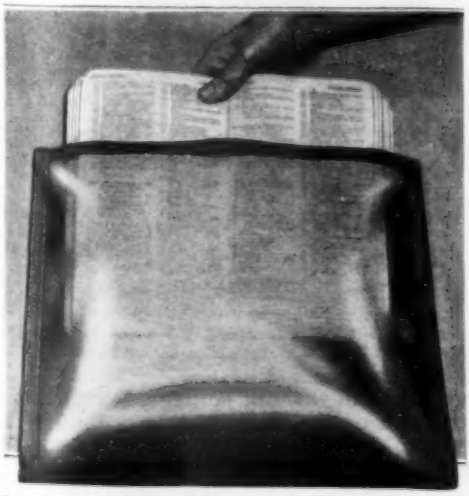


Jackknife Sculptor with Some of the Many Articles He Has Whittled from Blocks of Wood

Washed up by the tides, dozens of soft-shelled crabs were gathered along the beach by residents of a town on the Delaware bay a short time ago. To gain the full benefit of the unexpected harvest, the whole village turned out and men and women worked in relays day and night, using lanterns and flare torches to light the waters after darkness. More than fifty dozen of the crabs were picked up in a few hours, according to reports.

WATERPROOF AUTO MAP CASE CUT FROM SIDE CURTAINS

Discarded automobile side curtains and a piece of celluloid may be fashioned with little trouble into a waterproof case for carrying maps or touring guides. The material is cut to the desired size and stitched around the celluloid, thus forming an open bag into which the maps can be slipped. They are plainly visible through the transparent covering, and are protected from wear, dust and the weather.



Transparent Guide-Book Carrying Case with Automobile Side-Curtain Back and Celluloid Top

CHICKENS ARE FED ON GRAVEL TO DECEIVE BUYERS

Charges of trickery were referred to in a report to the New York Live Poultry Receivers' association by one of its counsel recently. It was asserted that about forty-eight hours before the poultry reached New York, the birds were starved until the day of unloading. Then there was put down before them a substance of ground oyster shells, sand and gravel mixed with meal and a sprinkling of red pepper. The pepper was to make them thirsty, it was said. An hour or so later they were given plenty of water mixed with "shorts." Sometimes cement was added. The result was declared to be a solid, indigestible mass in the crop of the birds that added from a quarter to a pound and one-half in weight, which deceived the buyer.

RUBBER PATCH ON SHIP'S HULL TO PREVENT ITS SINKING

To prevent a ship from sinking after it has been rammed and a hole pierced in its hull, a patch has been invented that stops

Model of Ship and Rubber Patch Designed to Prevent Sinking of Vessels after Collisions

the leak when it is dropped over the side. The patch is padded with rubber and is attached to a line that is carried through the break by the inrush of water. A pull tightens it so that the vessel may proceed on its way.

GREAT FUTURE IN ELECTRICITY PREDICTED FOR AMERICA

Although scarcely more than fifty years ago there was nothing electrical in industry, no generators, motors, transmission lines, lights, communication or traction, today the entire fabric of modern civilization is interwoven with a complex and indispensable tissue of electrical power.

What has been the electrical industry's contribution to progress? What is it now doing to advance human wealth through the promotion of more efficient production? Most important of all, what is it likely to do in the immediate future? May we expect an equal or greater advance in electrical science and industry in the next half century, or has the rapid growth of the last fifty years brought it to the saturation point?

These are some of the questions taken up by Gerard Swope, president of the General Electric company, in a report to the stockholders of the organization. He declared that motors are now doing the work of 170,000,000 men and that electrification of the railways in the United States will save 100,000,000 tons of coal a year.

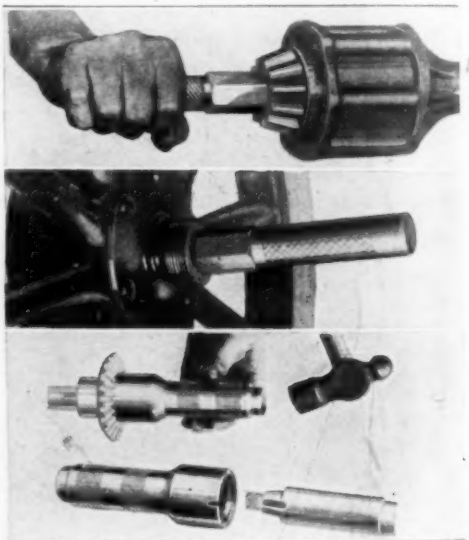
"Intensity of research in water-power development—the rapid succession of developments—the fervor of engineering investigations—all these are going forward at a rapid rate," he said, "and are far ahead of the appreciation of the general public of the service that electrical appliances will render in the future."

DO MOTHS SMELL CAMPHOR?

Moths may be kept from destroying cloth materials by a chemical which is believed to exist in green aniline dye, according to experts working on the subject in Germany. The emerald coloring is said to have caused fabrics in which it is used to be immune to the attacks of the pests. Camphor balls and naphtha treatment have been insufficient protection, according to some authorities, who believe that since moths have no sense of smell, gaseous odors will not repel them.

AUTO-WHEEL PULLER GUARDS AXLE FROM ANY INJURY

To prevent injury to the axle in the removal of the rear wheels of an automobile, a puller has been designed to do the work



Simple Wheel Puller Designed to Prevent Injury to the Axle Shaft of Automobiles during Removal

quickly and without damage. It screws on the end of the shaft, the base forming a rest so that pressure may be safely applied through a center pin. The threads also are protected while the wheel is being jarred loose.

Preparing Material from Reference Room for Package Libraries

Fortune Spent Yearly to Answer Queries from Hospitals All over World

ANSWERING hundreds of questions concerning the equipment, management and needs of hospitals all over the world, and giving information which will assist doctors and nurses in the care of the 800,000 patients who are fed, housed and tended daily in the 7,095 hospitals and sanitariums of the country, is the task of one of the most important clearing houses of information in the world, the Hospital Library and Service bureau. In the same building are closely related activities, the national headquarters of the American Hospital association and the editorial offices of a great hospital magazine. Together, these organizations spend much more than $100,000 each year just to answer questions. They serve every state in the union, every province in Canada, and their aid goes to the remotest outposts of civilization.

The magnitude of the task is seen when it is realized that the modern hospital is one of the most complex of present-day institutions, that the number is increasing rapidly, and that amazing developments are being made almost daily in medical science. The "answer factory" must keep abreast of the times. Its files must be equipped not only to give full data on the latest methods of community health organization, but must have facts and figures concerning building materials, plumbing, disposal of waste, and legal and financial matters. The bureau was established in 1920. It is supported by the Rockefeller Foundation and by contributions from national hospitals, nursing and medical organizations and individuals. It is designed not only to save hospitals the expense of private libraries, but to do necessary research for the entire field. Service is given free to "bona fide hospital executives, trustees, building committees, health officials, or others officially connected with hospitals or

Statistical Charts Showing Important Hospital Information for Reference and Educational Displays

engaged in welfare work." One of the most complete and comprehensive hospital libraries in the world is maintained by the bureau. A force of young women is kept busy constantly compiling clippings and formulating data. More than 1,400 volumes on hospital subjects, 1,500 pamphlets, a file of 167 hospital, health, architectural, engineering and medical journals, and 6,000 reference books are in the collection. More than 200 subjects are covered in the 783 little libraries already in circulation and the extent of the data is growing constantly. "When it is considered that our country alone spends more than $1,000,000,000 each year in caring for the sick in hospitals, and that the new construction and equipment program for this year involves at least $300,000,000, the importance of a source of accurate information for all persons connected with this work is seen," said an official of the bureau. "The modern hospital is a vast engineering enterprise as well as a place to take care of the sick." Much of the material, including a large collection of plans of hospitals of various types and sizes, is exhibited at meetings in different parts of the country. Thus this institution not only meets the needs for information from its callers, but, through correspondence, package libraries, and exhibits, extends its service widely.

SCULPTOR CARVES ICE BLOCKS FOR WINDOW DISPLAYS

With skillful strokes of his tools, a western sculptor cuts lifelike figures of birds, animals and other subjects from solid blocks of ice for window displays. In less than an hour, he is able to fashion the forms of rabbits, an American eagle, or other designs. Smoothing the outlines is done by melting the ice with the hand.

Glittering Figure of Swan Carved from 300-Pound Block of Ice by Window Sculptor

HEATERS IN AIR MAIL PLANES KEEP FLIERS COMFORTABLE

Air mail pilots were kept warm during the winter months by heaters installed on their planes. Sheet iron welded around the motor exhaust on one side, opened at the front end, and directed into the cockpit by means of a tubing, enabled the aviators to direct the warmth generated by the engines to any part of their bodies. A valve regulates the amount of heat. On the top of the cockpit is stretched a strip of canvas attached sufficiently tight to hold against all ordinary wind pressures, but easy to tear out if it is necessary to use the parachute in case of accident. With these conveniences, flying in winter is said to be not only comfortable as to heat, but delightful as to scenery.

RED LIGHT TRAPS INSECTS

To combat the winged insect pests of tropical regions, a means has been devised by which the flying bugs are lured into a deadly acid bath and either drowned or asphyxiated by the fumes. It was found that red light served as an almost irresistible lure for the night-fliers and a colored lantern was placed near the vessel containing the acid solution. As the pests fly to the light, the fumes destroy them.

METER FOR BATTERY CHARGING HAS VARIABLE RESISTANCE

Combining an ammeter and variable resistance in one compact unit, a simple connector has been designed for charging storage batteries from direct-current circuits. A thumbscrew clamp is attached to the bus bar and a clip to the battery terminals. The ammeter shows the charging current, which can be varied by a turn of the knob mounted below the meter.

RADIO

Policing the Air to Protect Radio Fans

Government Inspectors Keep Ceaseless Vigil over Ether Lanes to Prevent "Jams" and "Collisions"

KEEPING a silent vigil over the ether, members of the federal radio-inspection department are constantly on guard to protect the rights of both amateurs and broadcasting stations. Their work is to see that licensed frequencies in every station are maintained, that programs are kept to the standards which have been agreed upon, and that the unlicensed operator who "jams" the air is hunted down and punished. Just a few years ago, when radio was confined principally to ships, the department of commerce took over the regulation of this means of communication. Inspection of the marine service is still one of the most important functions of the department, but so rapid has been the growth of radio that it has been necessary to divide the country into nine districts, over each of which a supervisor and a corps of inspectors are given full authority to regulate traffic.

Governmental authority, of course, is the "big stick" that assists these "ether policemen" in their work, but two ingenious instruments have been designed to aid them. One is a decremeter to measure the frequency of transmitting stations, and the other is an oscillator used in connection with a receiving set to "untangle" jams caused by conflicting transmitters. Both instruments are carried by inspectors on their rounds. The decremeter is placed near the coils of the transmitter and regis-

Adjusting Transmitting Amplifier in Station WMAQ under the Direction of Federal Radio Supervisor, Who Makes Four Inspection Calls Each Year at Every Broadcasting Station in His District

ters the frequency of the broadcasting station. The oscillator is adjusted to the incoming waves and will show if a sending station is off allotted wave length. Seated in his office, or at home with his special receiving set, the inspector can quickly straighten out an air-traffic snarl. The instruments show which stations are to blame. "You're five kilocycles too high," may be the message telegraphed to the offender, "Move down a bit." Most any night, while thousands of radio fans are enjoying their programs, a government radio inspector is issuing orders down the ether traffic lanes to prevent roaring collisions and smashups of the programs. Most broadcasting stations now have frequency indicators and can detect any deflection in wave length at once. The inspector, however, is guide to the many not so equipped.

Like Detectives, Radio Inspectors Shield Their Identity and Are Reluctant to Face the Camera

Tracking down the unlicensed operator and bringing him to realize the importance of co-operating with the rest of the radio family is one of the most important services of the "radio police." They do not strive to press criminal prosecution, although the statutes provide penalties. Persuasion is usually effective in convincing the "outlaw" that he should conform to the code. In this work, the federal men have the co-operation of amateurs and commercial stations. Sometimes, however, the chase is long and fruitless. Again, luck will play its part. Not long ago, Kansas City radio users, repeatedly annoyed by an unlicensed broadcaster who spoiled their programs and caused interference at all times of day and night, sent for a federal supervisor. After a few hours of patient waiting at his receiving set, the federal man caught the "outlaw call" and this message: "I'll meet you in an hour, doctor, at the garage." The supervisor grabbed a classified telephone directory. Under the list of garages he found a name with the initials that spelled the call used. Then followed a sprint for a cab and a dash for the garage. He arrived just as the trouble-maker was stepping away from his apparatus. The supervisor chatted a few moments and then prevailed upon the garage man to accompany him to the "doctor's" house, where both agreed to cease their activity.

"The radio fans are always willing to co-operate with the inspectors," says E. A. Beane, supervisor of the ninth district, who, with two assistants, is required to watch over 3,340 transmitting and 176 broadcasting stations in his territory, which

Supervisor E. A. Beane of the Ninth Radio District Seated at Special Receiving Set in His Home. From this Post He Nightly Keeps Order on His "Beat" with Aid of Oscillator

comprises about a dozen states in the central west. "Radio is becoming standardized and the average operator is educated to see the necessity for co-operation. New apparatus is being made constantly to lessen interference. Almost ninety-nine out of every hundred complaints of interference that we get are explained by electrical disturbance from some other source than radio apparatus. Amateurs, contrary to many reports, are not to blame for the majority of troubles. Many times it is the fault of the apparatus itself, but outside interference from a street-car trolley, poor wiring, an electrical machine of some sort, is most generally the cause of the radio receiver's trouble."

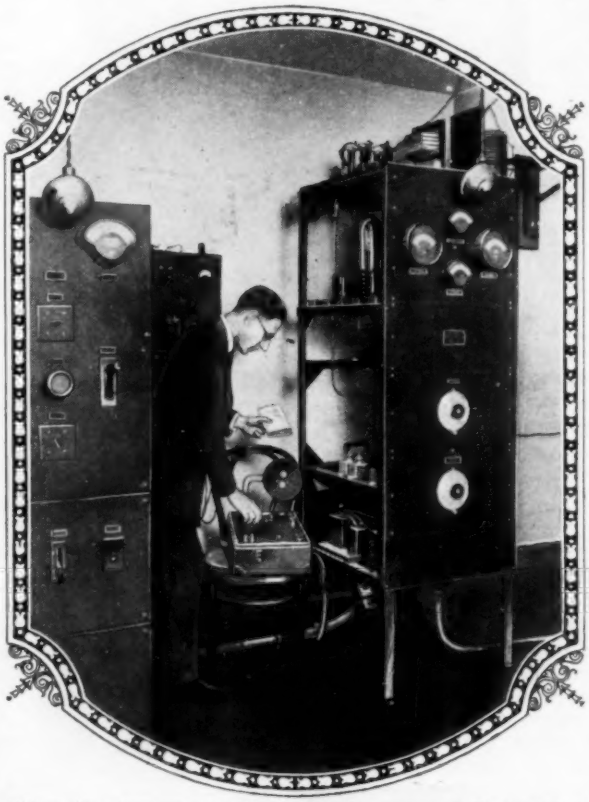
Mapping Radio District by Colored Pins Placed at Points where Transmitting Stations Are Located

When a storm, a few weeks ago, tied up transportation and silenced the telegraph wires, radio came to the relief of stalled trains, served cities and towns with news messages, and aided in many ways. The government "ether cops" supervised operations in the emergency. Amateur stations were authorized to operate on special wave lengths to assist in the relaying of messages. All stations were watched carefully and the air lanes were kept as free from interference as possible. From a transmitting set in a farm house on the plains was sent the message that brought plows to the relief of a stalled train, and other instances of aid were numerous. Answering the complaints of radio users throughout is one of the chief duties of the inspectors. Frequently reports arise from unknown sources and are put on the radio. There follows a deluge of queries to the inspectors. Maps are kept, showing with the aid of colored pins where the stations in the district are located and how messages can best be routed between points.

Not long ago, the marine-inspection service probably saved hundreds of lives by ordering new batteries in a vessel's radio outfit just before sailing. The ship was wrecked and boiler fires had to be drawn. This left the radio without power from the dynamos, but dis-

Close View of Decremeter Outside of Case with Exploring Coil Attached and with Others at Left. Connected with Head Phones, Instrument Can Be Used as Receiving Set

tress signals were relayed with current from the batteries. When the "S.O.S." is flashed into the air from a ship in distress, naval stations flash the "Q.R.T." signal, "Keep Off the Air." This stops all broadcasting, so that there may be no interference with attempts to locate the ship and speed help by radio if needed. The "ether police" keep vigilant watch to detect any violation of this order. Largely through the efforts of the radio inspection department and with the co-operation of naval officials, American vessels are being equipped to broadcast their signals on a 706-meter wave length, thus eliminating one of the chief sources of interference in the past. Some of the vessels are still using spark senders and their messages sent in this manner "go across the country like a buzz saw," frequently drowning out programs of near-by stations and interfering with receiving sets everywhere. Much of this interference has been stopped through a plan to have vessels, operating on certain wave lengths, stand by during the concert hours.



Using the Decremeter to Determine Frequency of Transmitting Apparatus in Station WMAQ, Chicago. Exploring Coil above Operator's Right Hand by Induction Registers Reading on Dial

During the fiscal year ending June 30, 1923, sailing from United States ports, there were 11,305 vessels that required radio inspection. The department examined and licensed 10,000 amateurs and 2,860 commercial operators. There were 541 licensed broadcasting stations and 16,570 transmitting stations to be inspected. For all this work, there were only twenty-nine inspectors. This is due to the fact that the department has been greatly handicapped by having to operate under the old radio law of 1912. New legislation is expected to provide for the enlargement of the force of inspectors, and for the appropriation of larger sums to aid the radio research department of the United States bureau of standards, where tests are constantly being made to devise new instruments to aid the radio police and to find apparatus that will eliminate interference for the benefit of the radio fan. A single device in this department has been arranged which has saved many thousands of dollars already and spared the inspectors frequent trips to Washington with their equipment. Once a month, "standard waves" are sent out from the bureau and are recorded on the decremeters of the inspectors so that they can determine if their instruments are accurate. Before this arrangement, they had to take the machines to Washington and waste a day or so waiting for the tests to be made. New broadcasting stations are constantly adding to the work of the inspectors. Before programs can be sent from a newly licensed station, it must undergo a thorough inspection by the supervisor in that district. Every detail of transmission and amplifying apparatus is examined to see that it has been installed properly; studios are inspected to determine if government regulations as to construction to avoid reverberation of sounds have been followed. This insures successful broadcasting and protects the radio user from possible defects in the sending apparatus. These faults sometimes cause the fan to blame his own set, whereas the trouble really lies at the source of the message in the sending set.

Crystal Sets May Hear London Stations

It certainly would be a great surprise to many radio listeners to receive London broadcasting stations on their crystal sets. However, this and other dreams of imaginative radio fans may soon be realized when the new transmitting apparatus invented by Guglielmo Marconi, the radio wizard whose inventions made radio communication practicable, is perfected. This signal piece of construction work in the radio field, which is based on extensive experiments conducted by the inventor and his colleague, Mr. C. S. Franklin, promises to revolutionize completely the present methods of long-distance transmission. The gist of the new invention, according to Mr. Marconi's announcement at a recent meeting in London, over which he presided, is that the radio waves are concentrated in the form of beams that can be projected in any desired direction. In this way all the power can be sent in one direction, thus intensifying the strength of the signals considerably over unheard-of distances, and the electrical energy required for such directional transmission is much less than the amount otherwise used. Marconi also stated that in his recent experiments with the new method he communicated with St. Vincent, on one of the Cape Verde islands, located approximately 2,400 miles from England, with much less power than otherwise used to span this distance, and receiving the signals much more clearly, and that he was led to believe that owners of crystal sets in America would soon be able to receive London broadcasting stations. The new method may also be used to guide ships through fog. The photos show the rough, but practical model of the apparatus, by means of which the radio beams were thrown across space for a distance of about 20 feet during the progress of the laboratory experiments.

Copyright, Underwood & Underwood

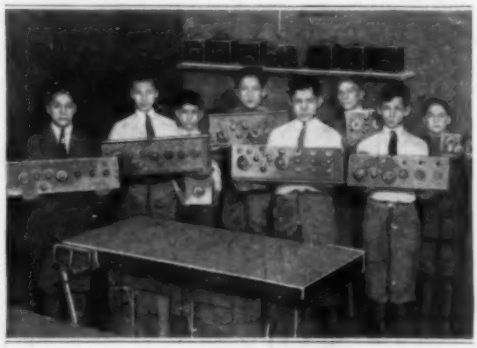
Above, Model of Receiving Apparatus; Below, Transmitting Apparatus for Throwing Radio Beams Through Space

Causes of Distorted Signals

Distortion is generally caused by too much regeneration, too much filament voltage, or too much plate voltage. Sometimes the cause is that the transformers are not properly balanced, or the amplifying circuit may be at fault. Noise is usually occasioned by loose connections, parallel wires, especially the grid wires, incorrect adjustment, poor make of grid leak, poor tubes, and cheap headphones.

Schools Train Future Radio Engineers

In the larger cities all over the country, radio courses are being given in the public schools. Both theoretical and practical training are given, the manual training and science departments usually co-operating to this end. In many cases the pupils combine both courses of instruction by building their own radio sets, as in the class in our illustration, which shows a group of New York public-school boys with radio sets of their own make.



Group of Boys in Public-School Class Who Have Made Their Own Radio Sets

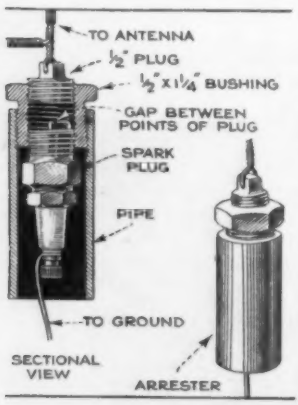
Loud Speaker Employs New Principle

Using a new principle for sound magnification, a novel loud speaker has been invented by a British engineer. The results obtained, it is said, are far superior to those secured with the "large telephone" type. A small, cork-faced steel pad rests on a rotating glass disk, and is held in position by "reins," which are attached to a pillar at one end and to the diaphragm of the loud speaker at the other. The pad is connected to an ordinary telephone receiver by a steel pin, so that the vibrations of the receiver are transmitted to the pad. The rotating disk drags the pad more or less, according to the pressure exerted by the pin, and the reins communicate this pull to the diaphragm, causing it to vibrate in unison with the receiver, but with a greater amplitude, or force. The disk is driven by a clockwork motor, which runs continuously for thirty minutes.

Left, Loud Speaker with Cover Removed; Right, Diagram Showing Principle Employed

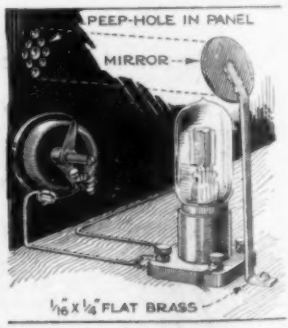
Spark Plug Makes Lightning Arrester

Good lightning arresters usually cost a dollar or more, but one that is just as dependable, is simple to make, and costs only a few cents, is shown in the illustration. It is made from a short length of pipe, a reducing bushing, a plug to fit the bushing, and an old ½-in. automobile spark plug. A hole is drilled through the square of the plug and the lead-in wire from the antenna securely soldered to it. The plug is then screwed into one end of the bushing while the spark plug is screwed into the other end and the short pipe screwed onto the outside over the spark plug as shown. The terminal of the spark plug is connected by an insulated wire to the ground. The parts are well tightened together and if they do not yet appear watertight they should be sweated together with solder. The spark gap between the points of the plug is the essential part of the arrester; it prevents the grounding of radio currents, but will pass charges of great potentials without much resistance, which is the necessary function of a lightning arrester.



Viewing the Filament

There are many tubes on the market that do not light up brightly, and it is nearly impossible to see whether they are lit by looking through the peep-holes of the panel, making it necessary to open the top of the cabinet to look down on the filament. A simple arrangement, which will show the filaments of the tubes, is shown in the illustration. It consists of a small mirror mounted on a flat-brass strip and bent over the tube so that it acts as a tiny periscope. The whole filament is reflected through the mirror and can readily be seen through the peep-holes.—F. J. Haas, Milwaukee, Wis.



¶Well-seasoned wood serves excellently for radio panels, in the absence of more suitable material, if thoroughly dried.

TWO SIMPLE REGENERATIVE RECEIVERS

By F. L. Brittin.

Part II—Triple-Coil Receiver

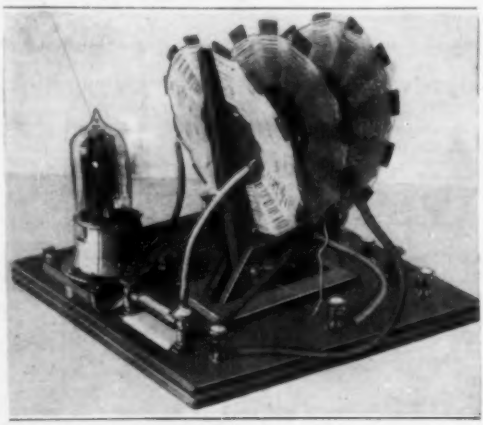
THE little receiver described in this article can be constructed from the odds and ends of material to be found around the average radio fan's worktable.

All instruments, with the exception of the rheostat, are mounted on a ¼ by 8 by 8-in. wooden base, which is raised from the table by means of two ¼ by ½ by 8-in. wooden strips, glued and bradded to the baseboard. The rheostat is mounted on a piece of scrap bakelite, ⅛ in. thick by 3¼ in. square, attached to the base by means of two small angle irons.

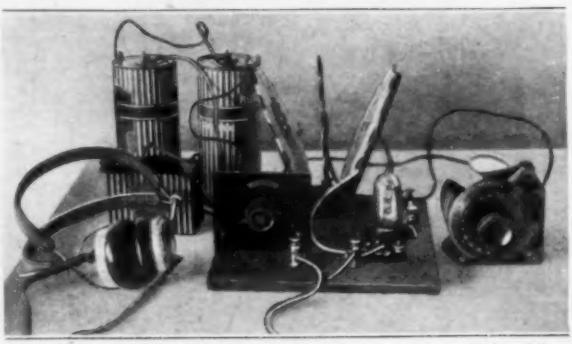
The coils used are standard spider-web coils, wound on forms that may be obtained from any dealer in radio supplies. No. 26 single cotton-covered wire is used for winding the coils. The primary and secondary coils are wound with 50 turns each, and the tickler with 45 turns. When counting the number of turns on a spider-web coil, always mark one "spoke" and count a full turn every time this mark is passed in winding. The wire is wound up through one slot and down through the next, so that when a 50-turn coil is completed there will be 25 turns showing on one side of each spoke and 25 on the other. The ends of the wire should be locked by drilling small holes in the form, and weaving the ends through them.

The primary and tickler coils are screwed to two wooden arms, which are pivoted on bolts passing through the sides of the coil mounting. The method of making the latter is shown clearly in Fig. 3, together with all dimensions. The uprights of the coil mounting are screwed and glued to the small base, and the latter screwed to the main baseboard. The bolts are provided with wingnuts so that the coils can be tightened in place when the proper adjustment is obtained.

The secondary coil is stationary and is held in an upright position between primary and tickler by two small cleats, tacked across the top of the mounting. A screw may be run through coil and cleats before tacking down, if desired, but this was not found essential in the original set.

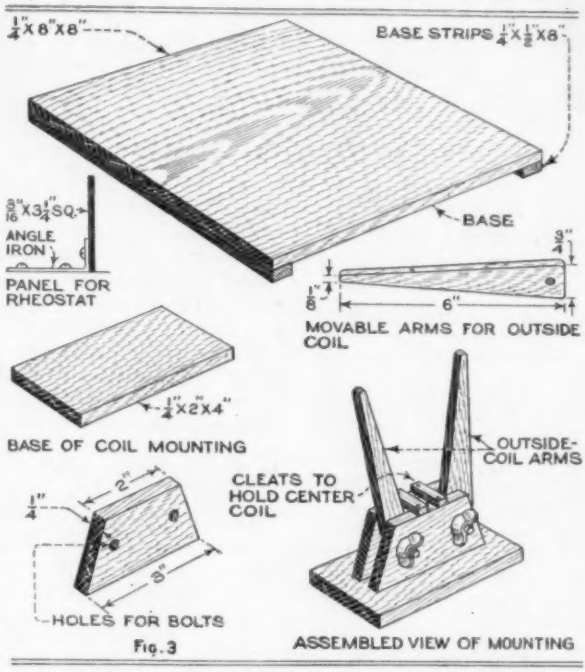


The primary coil can be tuned by means of a tuning arm made as shown in the small detail. A piece of heavy insulated wire is bared at the ends; one end is looped to fit a small wood screw and the other doubled over to form a smooth-running contact; the wire is then bent as shown. By placing the looped end on the wooden arm supporting the coil, a spot will be found where the other end can be swept across one of the spokes. The screw is driven in at this point, and a path made across the wires of the coil for the contact end by scraping the insulation from



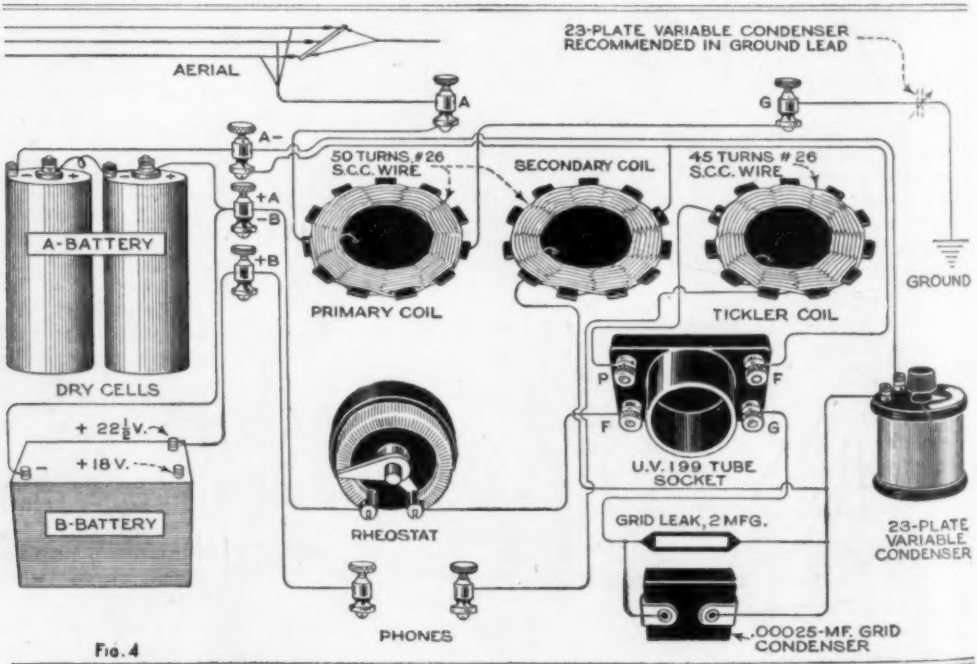
Above: Rear View of Triple-Coil Receiver; Below, Front View, Showing Rheostat Mounting

the wires. Care should be taken that the bared wires do not touch. This tuning arm is not essential, and may be omitted if desired. The end of the aerial lead is connected to the screw, if it is used. A better method of tuning is to use a 23-plate variable condenser in the ground lead, in addition to the 23-plate condenser connected across the secondary coil. Tuning is done by moving the primary and tickler coils toward and away from the secondary, and by adjusting the condensers, or the condenser and tuning arm. The only advantages that this instrument has over the preceding one are that scraps of material can be used in making it, that the coils may be wound for any wavelength, and that table-mounting instruments, which may be on hand, can be used. The ultra-audion is the better instrument for the broadcast listener.



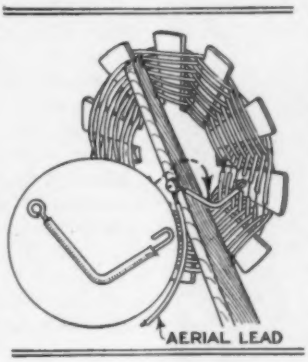
Details of Construction of Baseboard, Coil Mount and Arms

The circuit is wired with No. 18 rubber-covered wire, and the remarks made in the preceding article about soldering the connections apply with equal force to this instrument. The leads to the coils should be of flexible wire (lampcord). Two types



Simplified Circuit Drawing of Triple-Coil Receiver, Showing How the Various Instruments Are Connected

of aerial can be used with these receivers. The outdoor aerial, 80 to 100 ft. long, is the better, but a satisfactory aerial, where an outside one cannot be erected, may be made by running three turns of bell wire around the room, behind the picture molding. One end is left "open," and the other led down to the aerial post on the set. This aerial works very well for near-by stations, but cannot be relied upon for distance work.



A few hints that may be of service follow: Never burn the filament of a tube brighter than necessary to receive the signals clearly, as this shortens the life of the filament. Never go away leaving the filaments lit; all rheostats now have an off point so that this important detail can easily be watched. Don't work about the set with a screwdriver or other metal tool while the batteries are connected to the instrument, as the high B-battery current may accidentally be shorted through the filament of the tube, and will burn it out. These little details are easily remembered, and will often save the price of a new tube.

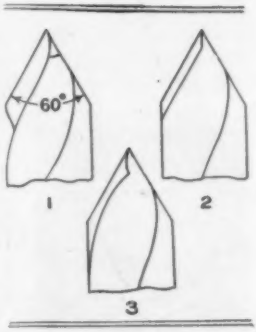
MATERIAL LIST
Triple-Coil Receiver

1 ¼" by 8" by 8"-baseboard.
2 ¼" by ½" by 8"-wood strips.
1 ¼" by 2" by 4"-base for coil mount.
2 ¼" by 2" by 3"-pieces for mount.
2 ¼" by ¾" by 6"-pieces for arms.
2 2"-stove bolts with wingnuts.
2 angle irons.
1 scrap piece of bakelite, 3-16" by 3¼" by 3¼".
3 spider-coil forms.
1 UV 199 or C 299 socket.
1 UV 199 or C 299 tube.
1 40-ohm rheostat.
1 .00025-mf. grid condenser with clips for leak.
1 2-meg. cartridge-type grid leak.
2 mounted 23-plate var. condensers.
7 binding posts.
2 dry cells.
1 22½-v. B-battery (small type).
1 pair 2,000-ohm phones.
1 lightning arrester.
1 ground clamp.
2 ft. lampcord.
20" No. 18 rubber-covered wire.
¼ lb. No. 26 s.c.c. wire.
100 ft. aerial wire.
50 ft. lead-in wire.

For the benefit of our readers, we have prepared blueprints of this circuit, 13 by 17 in. in size. These can be obtained from our Book Department, price 25 cents. Ask for Radio Blueprint No. 1.

Drilling Radio Panels

When drilling radio panels the best results are obtained by grinding the point of the drill to an angle of approximately 60°, as shown in Fig. 1, and grinding the front of the cutting edge flat to remove the hook shape. The correct method of grinding the cutting edge is shown in Fig. 2, and the incorrect method in Fig. 3.



Where power drills are used and speed or production is an important factor, drills from ⅛ to ½ in. in diameter should be driven at a speed of about 1,500 r. p. m. Where breast drills are used, any speed will be satisfactory and results obtained will depend upon the method of grinding the drill.

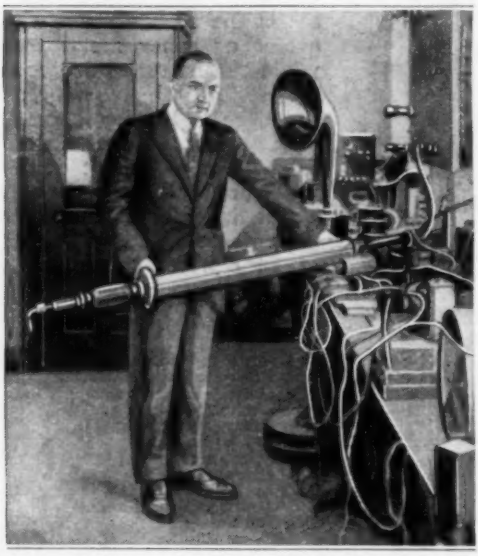
The tendency to break out on the underside of the panel due to improper grinding of the drills can be overcome to a great extent by placing a piece of wood or heavy cardboard under the panel while drilling. No woodworking bits should ever be used for drilling radio panels, only metal-workers' twist drills. Threading can be accomplished with ordinary machine taps, using a small amount of oil when threading, as this will help considerably in securing a clean thread.—A. C. Cole, Chicago, Ill.

Neat Double-Pole Switch Saves Time and Work

Double-pole, double-throw switches are used on many sets, to throw the aerial from a receiving to a transmitting set, and for many other purposes. Heretofore, however, it was necessary to drill the panel for each individual contact, a time-consuming and "fiddling" task. With a switch now on the market this is eliminated. The blades and contacts are mounted on an insulating base, which is attached to the panel with two screws. A template is furnished with the switch, to facilitate drilling.

Million-Watt Tube to Hurl Voice Across Ocean

Supplying energy equal to that necessary to light 40,000 25-watt lamps, or enough to light 1,500 homes, a new tube has been



Super-Tube that Alone May Carry Radio-Telephone Signals Across Atlantic

developed which, it is thought, will be powerful enough to carry radio-telephone signals across the Atlantic. The tube is fifty times more powerful than any now in use, and the tungsten filament is so large that, if drawn into filament of the size used for household lamps, it would provide for 175,000 such bulbs.

Radio Used in Movies

The filming of huge mob scenes, or battles, which used to be such a strain on the director and his assistants, has been wonderfully simplified by the use of broadcasting stations rigged up on the "lot," and amplifiers scattered about the location. Each group of players is given a number, and the director, seated in a spot from which he can survey the entire scene, merely gives his orders to the microphone, and they are repeated at once by the loud speakers. Formerly, much valuable time was lost in transmitting orders, but now the giving of an order is simultaneous with its reception.

¶Paris is to have the first radio newspaper in Europe. News will be transmitted by some of the country's most prominent writers and speakers.

Electric Smoke Consumers Interfere with Broadcasting

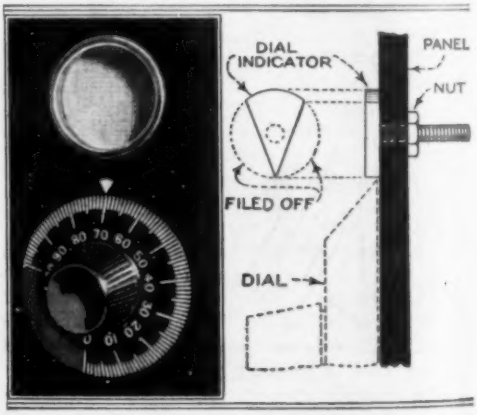
Some of the troublesome interference with broadcasting has been traced directly to disturbances caused by electric smoke-precipitating systems, which are used in some factories in the larger cities. Complaints against such interference have come from radio fans in Pennsylvania, Arizona and Montana. The precipitating systems interfere with broadcasting within a radius of about 20 miles. There is no law against interferences of this sort, and therefore the only available remedy is to call the attention of offending plants to the disturbance they are creating.

Fans Spend $150,000,000 for Radio

It has been estimated that the total expenditure for radio equipment by the public during 1923 has been $150,000,000, which is a considerable increase over the $75,000,000 spent in 1922. This, however, according to business authorities in the radio industry, is only the beginning of the boom, and it is anticipated that the amount spent for radio equipment will double every year for the next five years.

Panel-Dial Indicator

Home-assembled radio outfits often present an appearance just as good as any factory-made apparatus, with the exception of the indicating lines on the panel for accurate dial readings. A simple method of making a neat indicator is to file the head of a switch point to a triangular shape. The switch point is then mounted above the dial.—Glen Williams, Detroit, Mich.



Simple Indicator on Panel Is Made from Ordinary Switch Point Filed to Triangular Shape

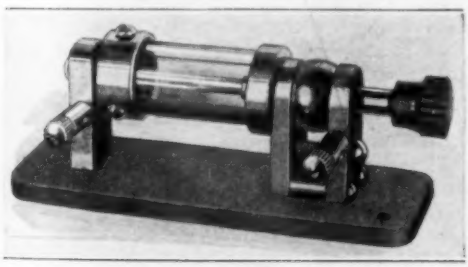
Records in the Making Will Be Broadcast

Two of the largest phonograph companies in the country will soon give radio fans an opportunity to hear records in the making. When famous vocalists or musicians are about to perform in the studio for recording on master records, a microphone will be placed beside the recording apparatus, and, as the artist sings or plays, the broadcasting station will transmit the music through the air. The public will thus be able to hear new "records" before they are put on the market. This should prove an extremely popular feature with receiving-set owners within a radius of the stations broadcasting this service.

Rugged Crystal Detector Retains Adjustment

Ruggedness and dependability are the most pronounced features of a new crystal detector. All parts are made of heavy brass, and the tension on the ball-and-socket adjusting device may be set and screw-locked, thus insuring that the adjustment will stay fixed when once a sensitive spot is found on the crystal.

The crystal and catwhisker are inclosed



Rugged Crystal Detector that Retains Adjustment When Set

in a heavy glass tube, assisting in keeping the adjustment set. The instrument is suitable for baseboard or panel mounting.

Lead-In Strip for Window

To eliminate the necessity of drilling a hole through the window casing to admit the lead-in wire from the antenna, a thin, narrow strip of copper, insulated with a double winding of ordinary electrician's friction tape, can be laid right on the window sill. It is bent carefully over the edges so that the window can be closed over it tightly. The copper strip is soldered at both ends to the lead-in wire.

Nickel-in-the-Slot Radio Appears in Capital

Radio at "a nickel a throw" has made its bow to the public in Washington, D. C.

Trimming Hair to Music from the Air Is Latest Novelty in Washington Barber Shop

An enterprising barber in the nation's capital has installed nickel-in-the-slot radio receivers in his shop, to amuse his customers while awaiting their turn, and to keep the youngsters from fidgeting while having their hair trimmed. This innovation should prove exceedingly popular in shops of this character.

Self-Contained Vernier Aids Tuning

Exceptionally compact and neat in design is a recent vernier knob adapted for all panel-mounted instruments. The large knob unit completely incloses the mechanism and carries an indicating pointer moving over a silver-plated dial, graduated full 360°. The dial need not be screwed to the panel, as it is slightly dished,

and, when the unit is pushed tightly against it, the dial is held rigid and flush against the panel. A light pressure of the knob toward the panel permits coarse adjustment, while allowing the knob to spring out again engages the vernier mechanism and permits very fine tuning to be done.

Reading Thoughts by Radio

Can thoughts be read by radio? "Madam Radora" seems to prove that they can. Madam is not a human being, but a life-size automaton shown at the Permanent Radio Fair in New York. Her "thoughts" and movements are controlled entirely by wireless; no wires of any kind are attached to the table whereon she rests, and a liberal reward is promised the person who can prove that this is not true. Persons desiring to ask questions simply stand before "Madam Radora" with their hands resting on a special pedestal carrying a number of electrical contacts. Radora then bends over her crystal, and answers the questions put to her in a clear, feminine voice.

Copyright, Underwood & Underwood

"Madam Radora," a Radio-Controlled Automatic Figure, Answering Questions in the Manner of the Gipsy Fortune-Teller, at New York Radio Fair

Inventor Forecasts Private Radio Systems

Private communication, on a par with the telephone, will be possible in the near future, Edgar DeForest, a Minneapolis engineer, predicted recently. His plan involves a central station, continuously in action, and equipped with both sending and receiving elements, operating with what the inventor calls "waveless wireless," without any alternating or pulsating current effects. Offices and homes would be equipped with small instruments, the cost of which would be nominal, and which, by automatic signals, would be put in touch with the person desired, so that the system would be limited to the two connected stations, just as with the telephone.

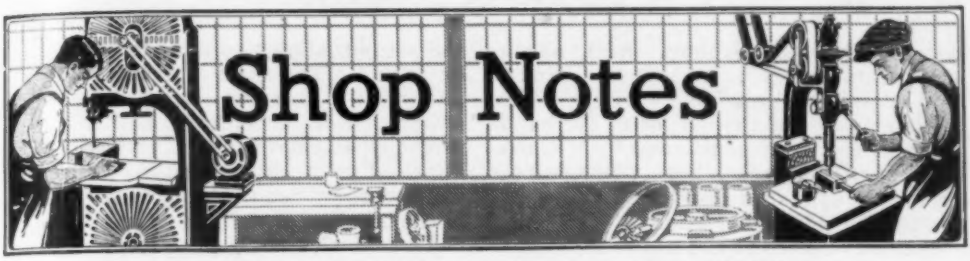
Radio Means More Work for Standards Bureau

Since the radio boom struck the country, the Bureau of Standards has been under a considerable strain, as many of the instruments used in radio sets are sent to Washington to be tested. The photo shows experts testing dry cells in a room kept at a constant temperature. Here cells made by every American battery firm are tested to make sure that they are fit to be put on the market.

Bureau of Standards' Experts Testing Dry Cells for Radio Apparatus

Soldering Connections

When soldering connections on radio sets the hot copper should be applied to the ends of the parts so that they will be heated when the solder is applied. It will then be found that the solder will run in and adhere much better than if dropped on cold parts. If rosin-core solder is used care must be taken that the wires are held together by the solder and not by the rosin, which is sometimes apt to happen. Heating the wire first, as mentioned above, so that the rosin does not form a thick film over it, will eliminate this trouble. A good paste flux is better than the rosin, as it flows easier. Never, under any circumstances, use acid-core solder or a flux containing an acid.



All Shop Notes published in 1923, in book form—Fifty Cents—from our Book Department.

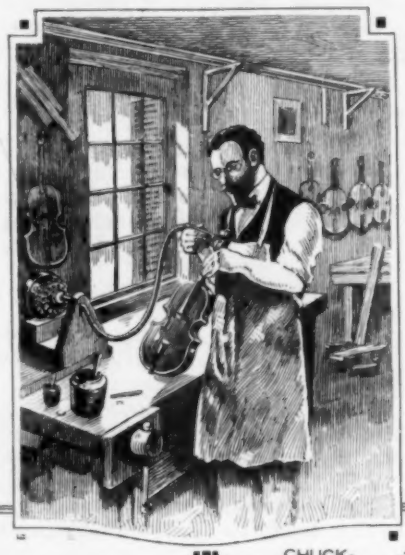
A Portable Drill and Grinder

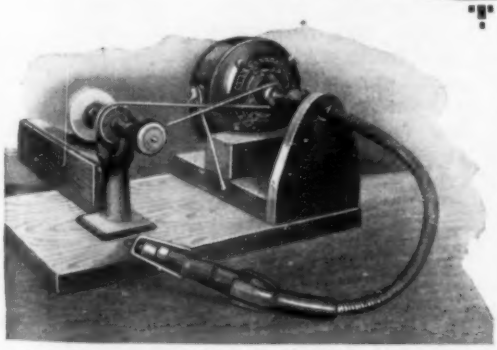
By D. R. VAN HORN

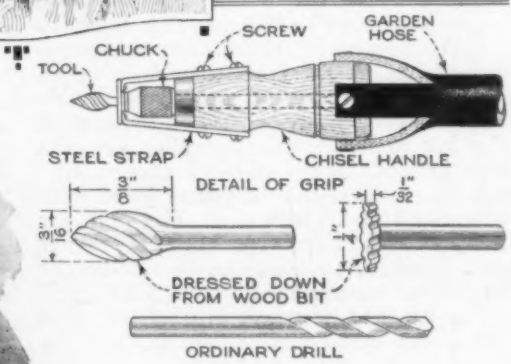
THE little tool shown in the illustration is in use in a second-story violin-repair shop in Lincoln, Neb. The proprietor, who is an expert in his line—making and repairing violins and other string instruments—uses it for dressing down wooden parts, drilling, inlaying, etc. But it is in some degree a universal tool, and as it is made from odds and ends of material, it should be of interest to all small-shop mechanics. The power unit is an old ¼-hp., 60-cycle fan motor, picked up for a few dollars. But let the owner describe the construction.

"I wanted a tool," he said, "which would fit my own purposes well. What I most needed was a tool for grooving violin backs for inlaying, which would duplicate the good work of other methods and save a lot of time. With this device I can run a groove around in twenty minutes. Having the motor, I sought out a flexible connection by which a chuck could be used, taking different tools. The part used, which, by the way, cost 75 cents, was found in a garage around the corner. This consisted of flexible housing, chain, and a steel shank from an old speedometer.

"The motor was set upon a wooden base, 2 in thick, 12 in. wide and about 20 in. long. The motor base proper is a second 2-in. piece, nailed to the larger base, and on one end of this is nailed a wooden piece as a sort of reinforcing or bearing for the end of the flexible shaft. On the other end of the main base is located a small grinder head. Here is also fitted a grooved rest, consisting of a short piece of 2 by 4-in. wood, which is used to do careful work with the grinder." But the chief point of interest lies in the method of producing a working unit on the free end of the flexible shaft. The chain







Made of Scrap Material, This Portable, Flexible Drill Can Be Built Very Easily, and Will Prove Valuable in Any Small Shop

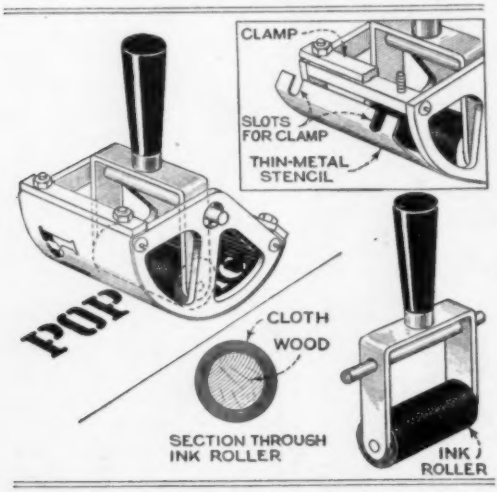
was attached to a short steel shank threaded on one end. To this was fitted a small chuck of suitable capacity. The handle from a wood chisel forms the hand grip, and this is strengthened by a short length of rubber garden hose. One end of the hose is split into four sections. This is then slipped onto the shaft, the ends spread and screwed to the end of the chisel handle. This handle is hollow and permits the shaft to be passed through it.

Two flat steel strips are also attached in the manner shown to add strength to the outer end. The shaft is connected to the motor by a threaded sleeve. The motor shaft carries a short collar which is threaded on the inside. The shaft is also attached to a short steel rod, threaded, which screws into the motor shaft. A few of the tools used with the shaft are shown.

All told, this portable unit does not exceed twenty pounds in weight. It has been in almost constant service for several years, and seems good for many more.

Special Stencil Expedites Printing

The common stencil and daubing brush is both crude and slow in comparison with the special stencil shown in the drawing.



Novel and Efficient Stenciling Machine for Labeling Boxes or Other Material

This was made up in a small shop to label boxes. The same idea can be used for stenciling any kind of material.

The drawing shows the details clearly. A frame of heavy sheet metal is made to hold the thin metal stencil. The side members of the frame are semicircular in shape, and are connected by crossbars, which carry the clamps used to fasten the stencil. The ink pad is a wooden roller, covered with several layers of soft cotton, and mounted in a U-shaped frame fitted with a handle and a pivot pin. The hole for this pin in the side frames is much larger than the pin, so that the roller can be pressed with sufficient force on the stencil.

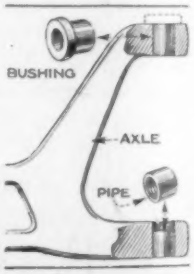
The manner of using is evident. The roller pad is soaked with ink, and the frame rolled over the material to be stenciled, pressing firmly on the handle.

Stacking Fiber Cartons

Warehouse workers complain that it is difficult to stack fiber cartons, when filled with product, so that the stack will not bulge out. A method which gives satisfactory results is as follows: Stack the cartons five high and then cover the top of the pile as it stands with building paper, or discarded cartons that have been folded so as to lie flat, so that the adjacent stacks of boxes will be held together by the weight of those above the paper. After another layer of boxes has been placed over the paper, place common laths all around the edge of the stack, between the fifth and sixth layers of boxes. The building paper ties the whole stack together, while the laths serve to tilt the outside boxes a trifle toward the center. In this way fiber cartons may be piled to the warehouse roof without danger of bulging.

Repairing Ford-Axle Spindles

I have discovered a method of repairing Ford front axles when the spindle-body bolt holes are worn egg-shaped, and when the threads are stripped in the lower spindle bolt holes. I have repaired six cars in this way with excellent results. First remove the axle from the car, put it in a vise, and ream out both holes with an 11/32-in. reamer. Then take a spindle-body bushing (part No. 2713), and force it into the top hole. Force a short piece of 3/8-in. pipe into the bottom hole, driving it in from the underside. This piece should go into the hole 5/8 in. deep. Now tap the bottom hole with a 1/2-in. 20-thread tap. This little job takes only 1 to 1½ hours to do after the axle is removed from the car. — Allen Knapp, Collinsville, Ill.

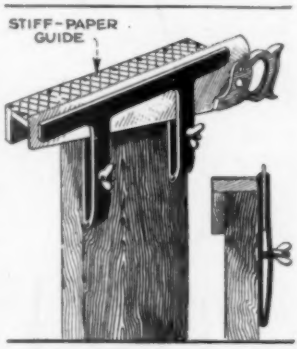


Painting Over Calcimined Walls

Interior walls are often painted nowadays instead of being papered. In preparing old walls for painting it is first necessary to remove the paper, paste, and calcimine which was previously applied. This leaves the walls in poor condition for the application of paint, as small pieces of thin paper stick to the walls here and there, and the plaster is usually cracked in many places, making it almost impossible to apply the paint successfully. The cracks should be filled up with plaster of paris and the walls filled with a liberal application of shellac, which has the consistency of glue. This will bind together the loose segments of plaster and will span the numerous small cracks without being absorbed into them as would be the case if paint were applied without this preliminary coating. After the shellac has been allowed to dry for half a day or so the wall can be given two coats of oil paint, allowing the first to dry before applying the second, and it will be found that the surface will not have the numerous high spots and dull places that would result if no shellac were used.

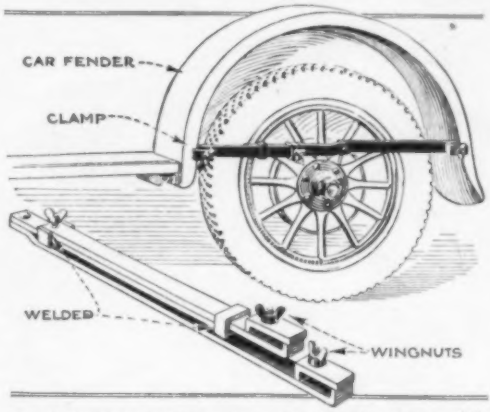
Guide for Filing Saws

Saws can be filed much more accurately by providing a guide ruled, as shown in the illustration, with lines at the correct angle for the saw being sharpened. This guide, which is simply a strip of stiff paper, is tacked to a length of ¾-in. board fastened to the saw clamp. The surface of this board must be about 1 in. below the edge of the saw teeth when set in the clamp so that it will not be cut by the file. When filing, start at the heel of the saw in the customary way and the eye will automatically follow the lines of the guide. Most saw clamps are made to clamp onto the bench-top directly, but this makes it necessary for the worker to stoop over, which is very tiresome. To make the work more convenient the clamp should be mounted on a piece of 2 by 10-in. material, and this piece securely held in the bench vise.



Automobile Fender Clamp

Every fender repairman has experienced the trouble of trying to keep a bar on hand to clamp to a fender in order to prevent it from spreading while shaping the edge.



An Adjustable Folding Clamp for Keeping Automobile Fenders True While Shaping the Edges

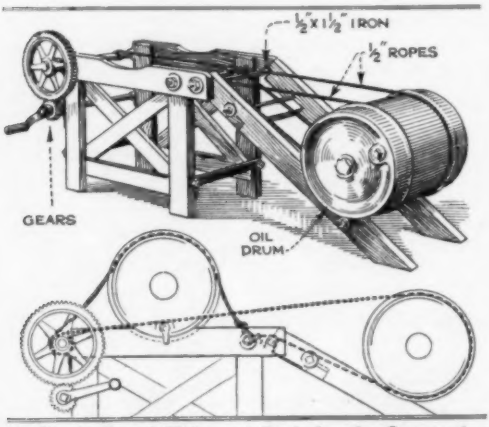
However, the folding bar shown in the illustration can be kept in the toolbox and is therefore not liable to be lost so quickly. It consists of two lengths of steel bar hinged together at the center with a rivet, and a third piece sliding on one of these. The sliding piece has a sleeve welded at each end so that it can only slide backward and forward and is held securely from moving any other way. A hole is drilled and tapped through the inner end of the sliding bar for a thumbscrew with which it can be tightened down, a number of spots being drilled in the other piece to take the end of the thumbscrew. Clamps of the shape shown are provided at the ends of the pieces to hold the edges of the fenders.—L. H. Candy, Bordeaux, Can.

Vacuum-System Kinks

The trouble frequently experienced with stationary vacuum-cleaning systems in that the pipes become clogged, is often due to the use of ordinary pipe fittings, as they are small and form excellent places in which matches, hairpins, and other objects may lodge. When installing a system of this kind it is therefore best to use pipes of large diameter and extra-large fittings. It is also a good idea to drill a ⅛-inch hole in the end of each pipe so that a little air will pass through the pipe all the time; this will dislodge any dirt that may have settled in a corner when the machine was shut down. Such a small opening will not affect the vacuum to any perceptible degree.

Barrel Hoist and Rack for the Garage

Oil drums in garages are usually placed on racks a few feet from the floor, but considerable difficulty is often experienced in



A Simple Barrel Hoist and Rack for the Garage that Can Be Operated by One Man

lifting the oil drums up on the racks. A simple hoist for this purpose, which can easily be operated by one man, is shown in the illustration. It consists of a winch arrangement attached to one end of the rack. A large gear is keyed on one end of the winch and a small gear, meshing with the larger one as shown, has a handle attached so that the winch can be turned.

A skid is hooked to the rack for the drums to be rolled on, which is accomplished by means of two ½-in. ropes, attached at one end to the winch and at the other end to the rack. These ropes must be long enough to be passed around the drum when it lies on the floor close to the skid. Winding the winch then rolls the drums up over the skid and onto the rack. The top edges of the rack are notched for the drums to rest in, so that there will be no danger of them rolling off.

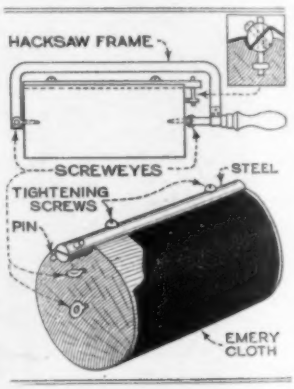
Rotating Crops

Nearly every farmer is beginning to realize the necessity of crop rotation as a means of restoring and maintaining the fertility of soils. Systematic crop rotation is the regular changing of crops on certain soils to prevent them from becoming exhausted of particular plant foods, as different crops require different kinds of food. By rotating crops the injury caused by insects and bacteria is also lessened considerably.

Due to the great variety of climates and soils, and crops that are particularly suited to them, it is impossible to adopt any standard system of crop rotation, and each farmer must, therefore, devise his own rotation system, as influenced by the above-mentioned factors, as well as the local characteristics of his farm. In general, a good rotation system is based on the regular alternation of three main classes of crops, namely; grain crops, grass crops, and cultivated crops. In the middle west, many farmers devote one-eighth to one-half of their farms to corn and the rest to grass one year and simply reverse the crops on these fields the following year, instead of growing the same crops on the same soil every year. Such rotation does not require much planning and will not reduce the income per acre, but will rather gradually increase the income by increasing the fertility of the soil.—E. R. Haan, Chicago, Ill.

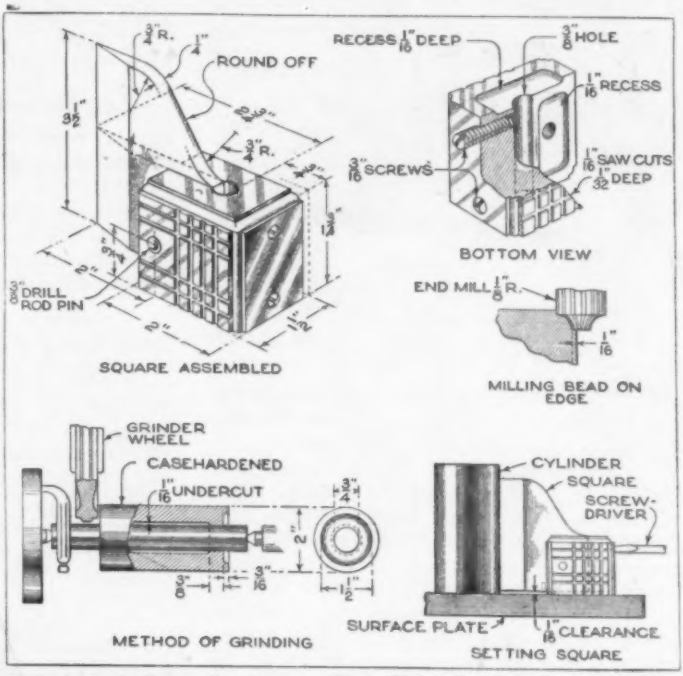
Polishing Concave Work

Concave grooves and slots, bearings, and many other similar jobs, can be neatly finished off with emery cloth if the latter is held in a suitable manner. One method of doing this is shown in the drawing, where a hacksaw frame is used to hold the device, the emery cloth being held on a round piece of wood, as indicated. The piece of wood is grooved along its length; either a round or a V-groove will do. Two screweyes are driven tightly into each end and a round piece of steel, a little longer than the piece of wood, is drilled and tapped for two round-head screws and is then split in two pieces. To tighten the emery cloth on the wood, one end of the cloth is inserted in the slot in the steel rod at one side, the other end at the other side, and the two screws tightened up securely. The overhanging part of the rod carries a pin, as shown, which fits loosely in the hole so that when the cloth is tightened it can be stretched tightly around the wood by giving this pin a quarter turn. To hold it in this position it is pushed down to enter the eye of the upper screw. The whole thing is then placed in a hacksaw frame and tightened.



A Toolmaker's Square and Test Block

A toolmaker's square, embodying a number of original features, is shown in the drawing. The square blade, of tool steel, is formed as illustrated, and finished to dimensions by grinding. The blade is supported in a steel block containing a slot into which the blade is inserted, and held by means of a pin passing through both members, so that the blade is, in effect, pivoted. The surfaces of the blade slot are recessed to make it easy to grind out the slot accurately; the recess is made with the side of a small end mill and is about 1/16 in. deep. Two holes are drilled through the center of the base, in line with the slot, and tapped to take the two adjusting screws by means of which the blade is lined up. It will be found necessary to drill a hole through the block at right angles to those drilled for the adjusting screws, in order to permit the tap to bottom. The blade should fit snugly in its slot without the least side play. The bottom of the base is recessed and the sides are checkered to provide an easy grip. The base can be finished by lapping with emery flour and oil to a high polish and the grooves in the sides can be filled with black enamel to accentuate the finish on the sides.



A Toolmaker's Square for Accurate Work Which Is Made So that It Can Be Checked and Adjusted by Means of an Accurately Ground Test Cylinder

The test cylinder is recessed at each end for 3/16 in., bored to fit the arbor used, and the bore is undercut for a part of its length, so that the hollow cylinder thus formed is supported on the arbor only at the ends. After being placed on an arbor and between centers of a lathe, the sides and ends are rough ground, the grinding wheel being dressed as in the drawing, so that the ends and sides can be ground at the same setting. After the rough-grind operation, the wheel is trued up again and the work is ground to its finished diameter. By grinding the cylinder in the manner described, it is evident that if it is exactly parallel throughout its length and the ends are ground at the same setting the block will stand squarely on the surface plate.

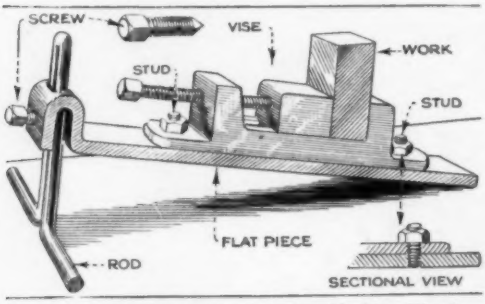
To line up the blade of the square, both it and the test cylinder are placed on a surface plate and the adjusting screws turned in or out as may be required until the edge of the blade is exactly parallel to the side of the cylinder. All parts should be made of tool steel, and casehardened.—Henry S. Laraby, New Haven, Conn.

Paper Edges on Wallboard Joints

It is customary to paste paper strips over wallboard joints so that the wallpaper to be laid over the board will not crack, which would greatly mar the appearance of the finished decoration. However, the edges of these strips will show through the wallpaper unless some method is used to make a featheredge. This is done by expert decorators in the following way: Before pasting on the strips turn up their edges on the outside about ½ in., making them U-shaped, then paste the strips on, applying the paste to the bottom of the U. After the adhesive is thoroughly dry tear off the turned-up edges, pulling them down and slightly toward the inside. This will remove all the paper that is not stuck to the wall, and leave a featheredge which will not show through the wallpaper.—James Ryan Haydon, Chicago, Ill.

Angular Attachment for Drill-Press Vise

In small shops a special vise is of considerable usefulness when drilling holes on an angle, which must otherwise be done by using packing on the regular vise. By



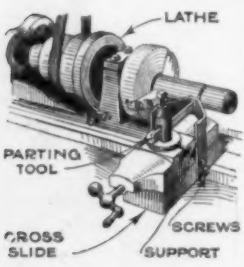
Attachment for Converting Common Machine Vise into Angular Vise for Drill Press

using the simple attachment shown in the illustration any ordinary machine vise can be used conveniently for this purpose.

First a length of flat stock is heated at one end and bent to the form shown. Then a piece of round steel is heated, doubled, and the ends bent at right angles. The flat piece is drilled and tapped in two places and studs screwed in tightly to hold the vise on the attachment. The top of the bent part is slotted to take the doubled rod, and drilled and tapped so that the point of the screw enters between "legs" of the doubled rod. To set the vise at the required angle the screw is loosened and the flat base is slid up or down and the screw tightened again, which causes the doubled rod to spring apart slightly below the slot.

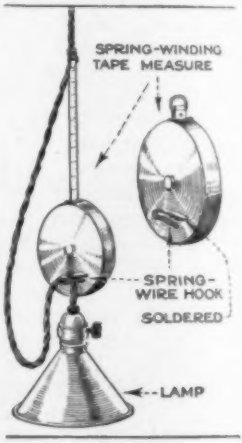
Supporting the Parting Tool

When cutting off bars of large diameter, especially brass stock in the screw machine, a good deal of chattering and digging in of the tool results from the need of having the parting tool extend well out and supported by the holder at a point where support is most needed. When a situation of this kind arises, the tool can be supported by the simple method illustrated. Take a piece of ⅜ by 1½ or 2-in. flat steel, bend it into a vee and then bend the ends to fit down over the cross slide. In the center of the vee, drill and file and finally broach out a hole with a piece of the parting tool used on the job; then caseharden the hole only. Fasten the supporting pieces to the cross slide by means of four screws—two on each side. The supporting piece is fastened to the bottom of the cross slide, leaving the top free to work back and forth as usual; this can be attained by packing out with washers, if necessary. The parting tool is held in a regular toolholder, and set to move freely in and out of the broached hole in the supporting piece. In this manner the tool is well supported from the beginning of the cut, eliminating all chattering and digging in, and cutting a clean, smooth groove clear through.



Drop Lamp Adjusted with Tape Measure

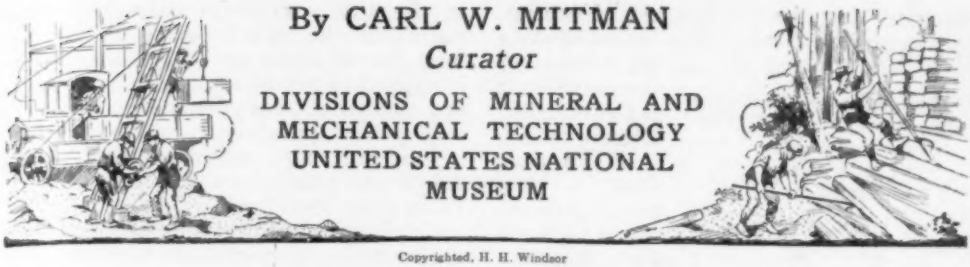
In a workshop where it was necessary to adjust the height of an electric drop lamp over the bench frequently, a simple and novel arrangement was employed that may recommend itself to home mechanics. When extended to full length the cord of the lamp was long enough to lower the lamp to the best position for close work. To adjust it instantly to a higher position an automatic spring-winding tape measure was attached as illustrated. A hook made of spring wire was soldered onto the outside of the drum inclosing the tape so that it could be attached to the lamp cord just above the lamp itself. The tape was then drawn out and the end attached by means of soft-iron wire to the lamp cord near the ceiling. To raise or lower the lamp with this arrangement it was only necessary to press the button of the tape measure, and release it when the lamp was at the desired height.—G. E. Hendrickson, Argyle, Wis.



¶To find a hidden rivet in a cast-iron handle apply some muriatic acid on the handle. This will cause the rivet to turn brown so that it can be plainly seen and driven out.

MECHANICAL POWERS

By CARL W. MITMAN
Curator
DIVISIONS OF MINERAL AND MECHANICAL TECHNOLOGY
UNITED STATES NATIONAL MUSEUM



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Part III—Friction: Wheel and Axle

THE discussion in the preceding chapter did not take into consideration any of the resistances met with in all machines. The chief one of these is friction. It was deliberately left out of the discussion, for the reason that its effect is realized under so many and variable conditions that were it considered in with the application of the principle of moments, for instance, no formula that could be applied to all cases could be arrived at. Furthermore, friction exerts such an important influence on the practical working of machines that theory is not of much actual use.

Mechanically speaking, friction is the enemy of efficiency. On the other hand, without friction it would be equally impossible to make or use machines, for nothing could be screwed or nailed or tied together or grasped securely in the hand, so that the advantages arising from friction are vastly greater than the loss of power that it occasions. Friction is the resistance to motion which takes place when one body is moved upon another. Two kinds are generally recognized, termed sliding friction and rolling friction; these are quite distinct in themselves and vary with conditions, especially with the composition of the two bodies, the conditions of loading, and the degree of lubrication. To illustrate: To move a block of stone weighing 1,080 pounds over a rock surface required a force of 758 pounds; when placed on a wooden sled, it was drawn on a wooden floor by a force of 606 pounds; when both surfaces were greased a pull of 182 pounds was sufficient; and when mounted on wooden rollers, 3 inches in diameter, a pull of 28 pounds was all that was required to move it. Friction during the movement of surfaces in contact is:

Proportional to the pressure exerted upon the sliding surfaces; independent of the extent of the surfaces in contact; independent of the speed of movement; greater between like than between unlike materials; greatest between rough surfaces, and greater with soft than with hard materials. Also that friction at starting is: Proportional to the pressure; independent of the extent of the surfaces, and generally decreased by polishing the surfaces.

Photo No. 1, Finished Model of Spanish Windlass; No. 2, Differential Hoist, and No. 3, Model of Capstan

Friction at starting and during movement is the same when the sliding surfaces are hard, but if they are compressible like wood, starting friction is much greater.

Rolling friction is quite distinct in character from sliding and very much less in amount. Investigation has shown, for

instance, that the relationship of friction to pressure of wood sliding on wood is as 36 to 100, whereas the rolling friction in the same case is as 6 to 1,000. That is to say, it is 36 per cent of the pressure in the former case, while in the latter the percentage is only .6. As said before, friction between machine parts lowers the efficiency, that is, the ratio of the power it is possible to take out of the machine and that put into it. In this connection, therefore, the following average values of efficiency in per cent are of interest: Ordinary bearings, 95 to 98; roller bearings, 98; ball bearings, 99; spur gears with cast teeth, 93; spur gears with cut teeth, 96; belting, 96 to 98; silent power transmission chain, 97 to 99; roller chains, 95 to 97.

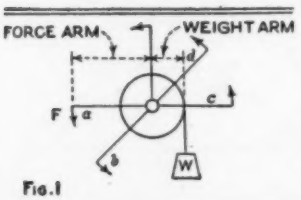


Fig. 1

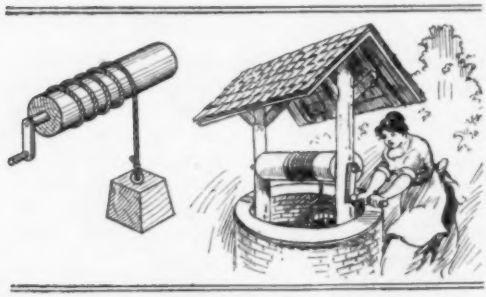
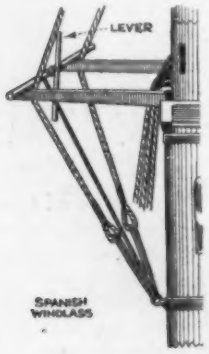


Diagram Illustrating Action of Wheel and Axle: Below, Example of Its Use

The Wheel and Axle

As a machine, the simple lever has its limitations, especially in raising weights, for after the weight has been raised it must be supported in its new position until the lever and its fulcrum can be again adjusted to repeat its action. To avoid this defect, engineers early decided that the fulcrum must be stationary and the lever must be made to revolve about it. The result is a machine or mechanical power known as the wheel and axle, in which the center of the axle corresponds to the fulcrum of the lever, the radius of the axle corresponds to the short arm of the lever, and the radius of the wheel corresponds to the long arm of the lever. To do work power is applied to the wheel rim and the weight is attached to a rope wound around the axle in the opposite direction. There are a great many applications of this mechanical power, altered more or less to suit a variety of conditions. For instance, instead of using a whole wheel, one or more spokes only are inserted in the axle or attached to it in some other fashion, the machine that results being the common, everyday windlass used in digging wells, raising water, in mine prospecting, in small derricks, and for numerous other purposes. Although the wheel and axle is a development of the simple lever, its action is not at all times that of a single type of lever, for at some points in a complete revolution of the wheel the action is that of a straight lever, while at other points it is that of an angular lever. This fact is made apparent in Figure 1, where there is represented in section a horizontal axle to which a single spoke of the wheel is attached. When the spoke or long arm of the lever is in position a, the work done compares with that done by a straight lever of the first order. The instant the spoke moves away from this position, the action of the machine is that of an angular lever or bell crank, as shown at position b, yielding less mechanical advantage than at a. By the time the spoke has made one-half a complete revolution the action has become that of a straight lever of the second order, as seen in position c, and with the least mechanical advantage. After passing this point, angular-lever action again comes into play, as at d and e, with an increase in mechanical advantage that reaches its greatest value again at position a.



Left, Capstan as Used on Shipboard; Right, Modern Motor-Driven Car Mover

An interesting modification of the wheel and axle is that shown in Figure 3, which is a reproduction of a model of the so-called Spanish windlass. This machine was devised primarily for use aboard ship for tightening rigging, and is therefore defined as "a wooden roller turned by a rope with a rolling hitch, and a handspike in the

bight." It will be observed that this nautical definition fully describes the model illustrated. Off ship the device is used to a certain extent on overtruck frames for suspending loads, and also for lifting heavy building materials for transportation. The similarity of its action to that of the common windlass is so apparent that further discussion is believed to be unnecessary.

Placing a windlass on end, that is, fixing the axis of the axle in an upright position, results in a machine known as a capstan. This machine likewise had its origin on board ship, as illustrated by the model reproduced in Figure 4. The coming of the steam windlass has, however, brought about the abandonment of the capstan for weighing anchor. In proportion to the men employed, the windlass is more powerful than the capstan, for a man can exert a force of about 150 pounds on a windlass spoke, but only about 35 pounds on a capstan bar. A greater number of men, however, can be used about a capstan, nor do the bars have to be disengaged as the machine revolves. To prevent backlash, a simple ratchet and pawl are attached. Capstans were used by the ancient Romans in transporting the Egyptian obelisks, and by the English, French and Spanish on ships of the fifteenth century, and up to the end of the nineteenth. Today they may be seen in use in heavy haulage such as moving buildings intact, operated either by man or animal power, and, motor-driven, for moving freight cars.

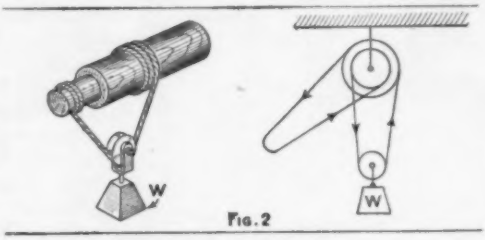
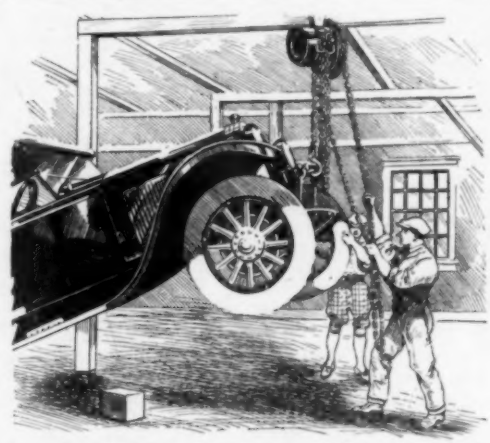


FIG. 2



Above, Diagram of Principle of Differential Hoist; Below, Example of Use of Hoist

Another useful application of the wheel and axle is that shown in Figures 2 and 5, the latter being a model of the Chinese windlass. This machine is also called a differential windlass. It consists of an axle of two diameters, the rope winding off one part of the axle and onto the other, and the amount of lift being governed by the difference in the diameters of the two portions of the axle. The combination of forces secured by this device gives extraordinary power, and at the same time the power is obtained without making the axle so small as to be too weak for its work. The use of a single pulley permits ease of attaching the load but does not increase the power. In use, the pulley and load are raised a distance equal to one-half the difference in the circumference of the two parts of the axle for each turn of the crank. If the rope is wound on to the larger drum and off the smaller, the load is raised; if the reverse, it is lowered. The effect is to make the weight arm of the lever very short, without the disadvantage of a weak axle, as mentioned above. Based upon this principle, Thomas A. Weston invented the differential hoist or chain block in 1854, substituting an endless chain for the windlass rope and iron sheaves for the wooden drum. The endless chain passes over a double sheave, as shown in the diagram, Figure 2, and around a single sheave beneath it having a hook to which the load is attached. The double sheave has two chain grooves, the diameter of one being somewhat greater than the other. Because of this variation a greater length of chain will pass over the larger groove at each revolution than over the smaller one, so that when pulling downward on that side of the chain which is on the larger sheave, this loop will be lengthened, but the loop around the lower or single sheave will be shortened and thus raise the load. By pulling downward on the side of the chain which leads to the smaller sheave the load is lowered.

For the model of the Spanish windlass, the following material is required:

Base, 8" x 4" x ¾".
Two pillars, 4" x 1" x ¾".
Two arms, 3" x ¾" x ½".
Beam, 9" x 1" diameter.
Lever, 4½" x ½" square.
Weight, base 1¾", top 1¼", side 1½".

Square and face the base with a finish bevel

on top. Bevel the pillars on four sides, ⅜ in. from the ends, and, on the center line of the base, erect the pillars and secure

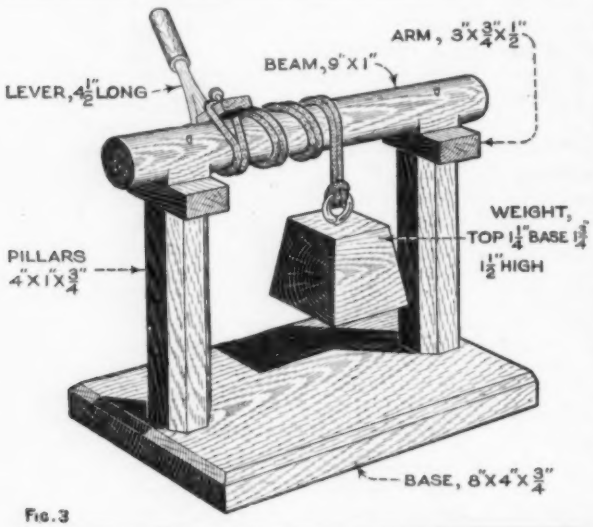


Fig. 3

Detailed Drawing for the Construction of Model of Spanish Windlass

them with glue and screws from beneath. On top of the pillars secure the arms with screws and glue, forming a T. To the screweye, used as a handle for the weight, attach a loop of cord. Lay the beam across the arms and wind the loop about the beam. The lever is fashioned with a handle and a shank with a slight offset near the end forming the heel. Place the toe of the lever in the extremity of the loop. Finish as desired.

In constructing the capstan model any suitable form of base may be used, it being necessary, however, that it be large enough to provide ample bearing surface for the axle of the capstan. In the original model, the capstan was mounted on the bow of a model ship as in actual practice, but a flat base will serve equally well for illustration. The materials given below are required:

Base, 4" x 3" x ¾".
Coarse hacksaw blade.
Pawl, ½" long.
Six bars, 2" long, 3-16" diameter.
Blank, 3" long, 1½" diameter.

Turn from the blank a narrow-waisted barrel with 1½-in. base, ¾-in. waist, and 1¼-in head, to the shape shown in the drawing. Drill the head with six radial holes, 3/16-in. diameter. Attach the capstan to the base, using a No. 12 screw of sufficient length to pass through the base, which is drilled oversize, and well up into the capstan. Anneal the hacksaw blade and with it form a ring 1⅝-in. inside diameter. Place this over the capstan and secure to the base with fine staples, permitting the capstan to turn within this ring. A pawl is a comma-shaped piece of metal, drilled through the round portion. Secure the half-inch pawl to the base of the capstan at such a distance above the toothed ring that the tail will engage with the teeth, permitting rotation in one direction but stopping it in the other. Insert the capstan bars into the holes at the top. The capstan may exert its pull upon the end or the middle of a rope. The former method is adopted where the amount of rope in use is too great to be wound upon the barrel, in which case the rope extends from the point where the pull is applied, thence several times around the capstan barrel, the extra rope being coiled or stored in a locker. The latter method is used where the amount of rope is not excessive and may be stored upon the barrel. In the former case the rope winds at the waist and slips upward. Finish as desired.

Use the following materials for the Chinese windlass, or differential hoist:

Base, 8½" x 6" x ¾".
Two uprights, 10½" x 1½" x ½".
Two corner blocks, base ⅞", altitude 1¼", width 1½".
Blank to be turned, 2½" diameter, 10" long.
Crank arm, 6" long, ¾" wide, ¼" thick.
Two pulley sides, 2½" long, ½" wide, 3-16" thick.
Weight, base 1¾", top 1¼", side 1½".
Small wire hook, with cross eye, 1½" overall.
Two ½" washers.
Two 1½", 6-32 machine screws, with nuts.
Two dozen washers No. 6.

Square and face the base with a finish bevel

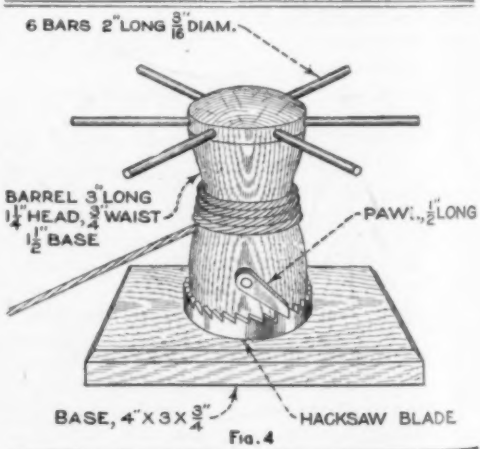
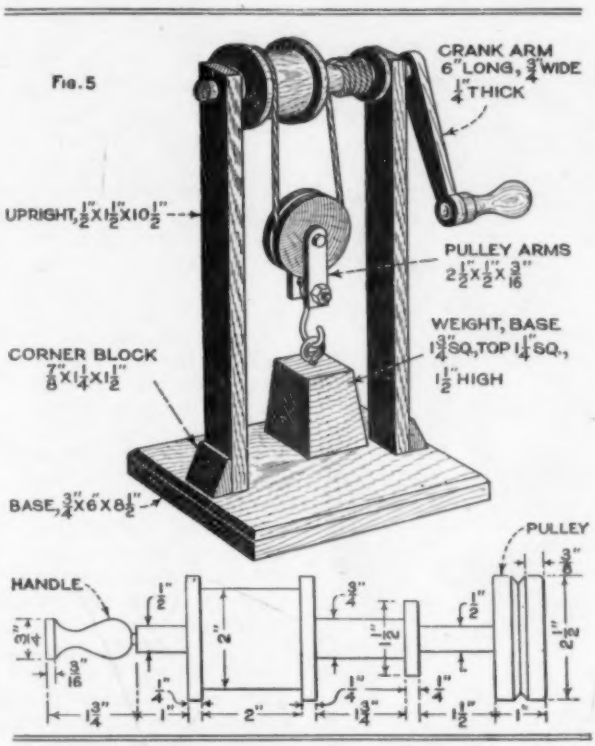


Fig. 4

Working Drawing for Model Capstan, with All Dimensions

on top. The differential axle, the pulley and the crank handle are turned from the blank to the dimensions shown in the drawing. The uprights are drilled with ½-in. holes, with the centers of the holes ¾ in. from the ends and from each side. The uprights are then placed on opposite ends of the differential axle, with the ½-in. washers between the axle faces and the uprights. This assembly is secured to the base by screws from beneath and by gluing the uprights on the center line of the base one and one-quarter inches from each end. The corner blocks are placed outside of the uprights to strengthen their position, and are fastened with glue and small brads. Holes are drilled in each end of the pulley sides. The pulley assembly is built up with a machine screw passing through the sides of the pulley, washers being used between the pulley face and the pulley sides. The hook is fastened to the lower ends of the pulley sides by inserting a machine screw through the holes in the pulley sides and the eye of the hook, retaining it in the center by washers. These machine screws are retained in position by nuts. Connect this pulley assembly to the differential by a cord passing through the pulley and wind over the drums of the axle in opposite directions, each end being fastened. Place the screweye used as the handle of the weight on the hook. To one end of the crank arm attach the handle by screwing through the arm into the handle. The other end is fastened to the projection of the axle by any secure method. Finish as desired.



Above, Assembly View of Model of Chinese Hoist; Below, Details of Barrel, Pulley, and Crank Handle

This is the third article of a series by Curator Mitman, explaining in simple language what every man who builds or designs a machine must know, and showing in detail just how to build a set of models of the mechanical powers that will exactly duplicate the set in the National Museum at Washington, D. C. The first articles of the series appeared in the March and April issues, and the next will appear in the June number.

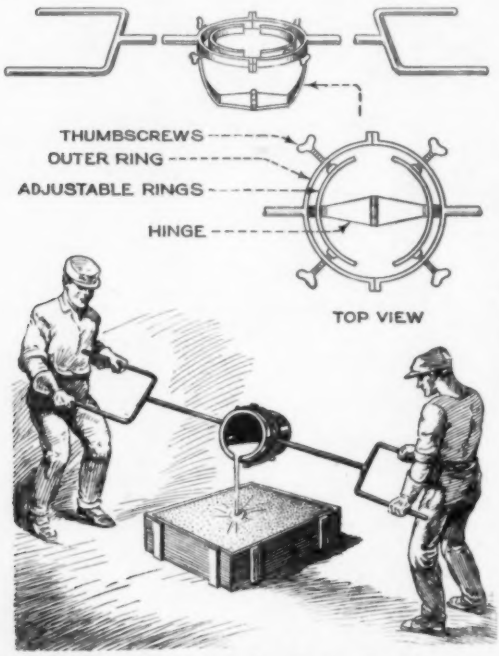
Keeping Dairy Barns Sanitary

There is no excuse for permitting the accumulation of manure in and around barns, especially dairy barns. The labor and time spent in keeping the barns clean are rewarded by a more sanitary condition, which insures better milk and offsets the danger of originating contagious diseases directly traceable to barnyard filth. An excellent practice, which is followed by many farmers, is to sprinkle hydrated lime over the floor every day. This not only tends to keep the stanchions dry, as the lime absorbs moisture, but also prevents undesirable odors and combats bacteria. Moreover, as the lime is removed with the manure it is spread out over the land where it is highly valuable as a soil fertilizer. If it is impossible to clean the barn thoroughly every day the bulk of the manure should be removed outdoors to a manure pile located at least 50 ft. from the barn.

Whitewashing walls and ceilings is also a step toward sanitation. This should be done not less than twice a year.

Double "Shank" for Handling Crucibles

Handling crucibles and ladles in the foundry is made much easier by using the double "shank" shown in the illustration.



Double "Shank" for Carrying Heavy Crucibles Has Been Found Convenient in Foundry

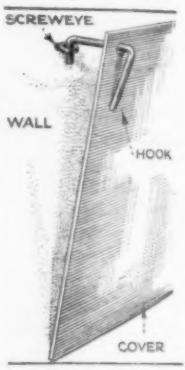
It is made of steel rod, of a suitable diameter to bear the weight of the crucible. Each separate shank is forged to one of two semicircular steel rings, which are held together by means of a heavy hinge, as shown in the upper detail, so that they can be opened to grip the crucible. The outer rings are drilled and tapped for four thumbscrews, holding two adjustable inner rings, which are screwed up against the sides of the crucible to hold it firmly and prevent it from upsetting while pouring. When adjusted to any size pot, the latter is gripped or released instantly by raising or lowering the handles.—J. R. Master, San Quentin, Calif.

Cementing Celluloid

An excellent method of cementing celluloid battery jars or other articles is to use glacial acetic acid. The surface to be mended must first be made perfectly clean by scraping lightly with a penknife, and the acetic acid applied with a fountain-pen filler. It is allowed to stand for a few minutes and then the two parts are pressed firmly together, being left under pressure for 4 or 5 minutes. In this way patches have been applied to the bottom of the battery jars while they were being charged. —G. E. Jones, Mussoorie, India.

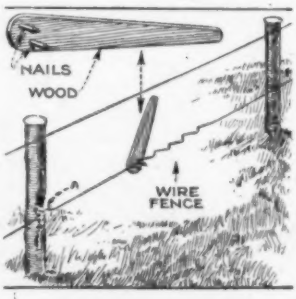
Novel Hook Hangs Metal Sheets

In a concern where sheet-metal covers are used on a bench operation it is necessary to clean and repaint the covers on both sides frequently. The most convenient method of holding the covers while the paint is drying is to hang them up on the wall on the hooks shown in the photo, which were especially devised for this purpose. To hang up a cover the hook is first passed through the hole in the top, and the other end is slipped into a screweye driven into the wall. The weight of the cover causes the end of the hook to press against it, thereby forcing the bottom tightly against the wall. Before hooks of this kind were used, the covers were loosely hung up clear of the wall and consequently any draft of air through the room caused them to swing about and become marked, but since the hooks were used this trouble has been stopped.



Quick Method of Tightening Wire Fence

It often happens that fence wire stretches considerably and sags, due to various reasons. A quick and effective method of tightening the wire consists merely of drawing up the wire on a post by doubling it and then nailing it down securely by means of a staple, as indicated at point A of the illustration. Another method is to make a number of sharp bends in the wire by means of a short length of wood having two nails driven through the end.

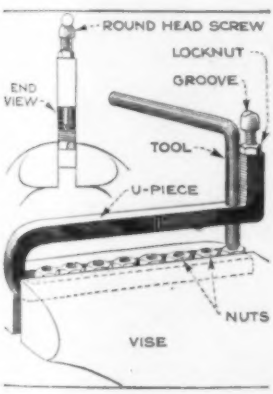


Pipe-Cleaning Tool

In cleaning an underground pipe, the regular jointed-wooden sticks that are made especially for this kind of work were not at all satisfactory. The work was, however, quickly accomplished by means of a length of telephone-post guy wire, which was stranded and somewhat flexible. A ball of solder about 1½ in. in diameter was wiped on the end and this end then pushed through the clogged pipe, with the result that the obstructions were easily dislodged. The guy wire was stiff enough to be pushed forcibly against the obstruction and still flexible enough to go around quite a bend, although it could not pass an elbow. It works best in 4 and 6-in. tile pipe.—A. S. Jamieson, Springfield, Mass.

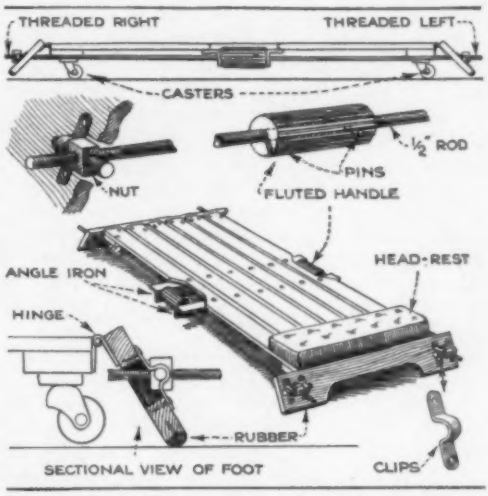
Hand-Operated Chamfering Fixture

It is sometimes possible to do a job much more quickly by hand than by machine, in cases where a small amount of metal is to be removed. This is clearly illustrated by the device shown in the drawing, which was made to chamfer or remove the sharp edge on the back side of brass nuts after they are cut off by machine. A length of square-steel rod is bent to U-shape, and one end bent up at right angles. This part is drilled and tapped in the end for a special round-head screw with a groove filed on the top. The chamfering tool is made of tool steel, fluted on one end and bent at right angles to form a handle. This passes through a hole in the U-piece. The whole fixture is gripped in the vise and operated in the following way: As many nuts as possible are placed in the slot formed by the vise jaws and the U-piece, and the nuts fed under the tool. One revolution of the tool is sufficient to chamfer a nut. The purpose of the round-head screw is to hold the tool clear of the nuts at the end of each revolution. This is done semi-automatically as the handle rides easily up the screw head, and with the tool out of the way, the next nut is pushed beneath it.



Creeper with Adjustable Feet

Although a creeper is an indispensable piece of garage equipment, many auto mechanics prefer a piece of old carpet or robe, as this gives a much more steady support to lie on while pulling nuts tight; it allows them to pull hard without the danger of slipping and injuring themselves.



Auto Mechanics' Creeper Provided with Rubber-Tipped Feet that Can Be Let Down to Make It Immovable

A creeper that has the advantageous features of a robe in this respect, and still can be pushed around on casters is shown in the drawing. It is provided with four rubber-tipped feet, which are hinged on the ends and can be lowered or raised by means of two ½-in. iron rods, passing through them as shown, a fluted handle being provided on each rod to turn it. The ends of the rods are threaded right and left for nuts pivoted on the feet, and the feet are drilled to fit loosely on the ends of the rods. Turning the rods thus raises or lowers the feet.

Ordinary casters are provided at the four corners, allowing the creeper to be rolled into any desired position. When it is necessary to tighten nuts or do similar work requiring a steady support, the feet are simply drawn down to the floor and the creeper becomes immovable.

¶ Denatured alcohol, squirted into the cylinders through the spark-plug holes at night, when the engine is warm, will loosen up the carbon deposits, and the carbon will be blown out of the exhaust when the engine is run the next morning. On starting, the engine should be raced a few times with the spark retarded.

Making a Hydraulic Ram

By L. B. ROBBINS

WHERE there is a natural fall of water a hydraulic ram is an ideal means of elevating water to a storage tank some distance away. The hydraulic ram is a self-acting pump which utilizes the momentum or energy of a slight fall of water to force a part of the water to a height many times that of the fall. The simplicity, durability, and effectiveness of this device make it one of the most useful as well as the most economical of the machines used for pumping water to elevated points. Its main advantage is that its operation necessitates no labor or expense, as, once started, it continues to pump day and night without attention, as long as the supply of water is sufficient.

The principle of operation of the ram may be understood from a study of Fig. 1. It consists simply of an air chamber or dome, fitted at its bottom with a valve opening upward, and connected, below the valve, to the supply or drive pipe leading from the river, pond, or other source from which the water supply is obtained. The continuation of the drive pipe is closed at the end, but a side outlet is provided, which is fitted with a check valve opening inward. The water flows down through the supply pipe, and out through the check valve until the velocity, or constantly increasing pressure, closes the latter. This, of course, stops the stream suddenly, and the shock caused by this sudden stoppage forces the dome valve open, this being the only other outlet. Through this valve, some of the water passes into the dome and delivery pipe. When sufficient water has passed into the chamber to relieve the pressure, the dome valve closes, the outlet check valve opens, and the cycle of operations is repeated. The air in the dome acts as a cushior., absorbing the shocks, and keeping up a steady, even flow through the delivery pipe.

It is obvious that a portion of the water is wasted to operate the ram, through the outlet valve, but, as this water is obtained at no cost, and no attention is required, the low efficiency of the ram may be ignored.

Such a ram can be made by the handy man from pipe fittings. The one illustrated in the drawing is designed to deliver only a maximum of one quart of water a minute, but, considering the fact that it works 24 hours a day, that is quite sufficient to store a considerable supply against the drain by an ordinary household. In other words, one quart a minute means 360 gal. in 24 hours. This is approximate, of course. As a ram delivers about one-seventh of its supply this one will require about 2 gal. of water a minute; a quantity which should be found in the smallest stream. It will elevate about 7 ft. for every foot of fall from the head of supply to the ram, but a fall of less than 2 ft. will not operate it.

By consulting the drawings the construction will be found quite simple. The air dome consists of an 8-in. piece of 6-in. pipe, capped at each end. The top is tapped and furnished with a plug for cleanout purposes, while the bottom cap is tapped for 1¼-in. thread. A 1¼-in. close nipple is threaded into this hole, then a 1¼-in tee with a ¾-in. side opening. The bottom of the tee is then fitted with a 1¼-in. close nipple, fitting into a 1¼ by 2-in. bushing.

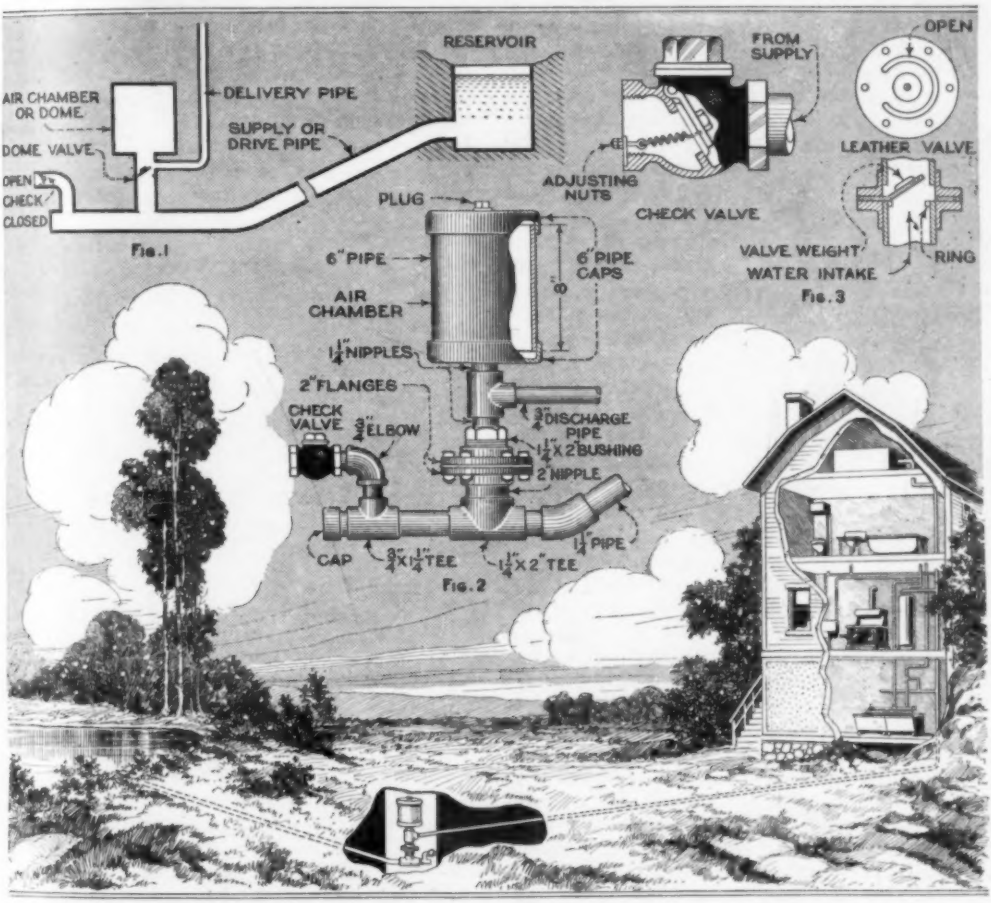
The supply valve is composed of two 2-in. pipe flanges bolted together on each side of a circular leather valve similar to a pump-deck valve. This is shown in Fig. 3. The leather should be arranged to lift up and admit water to the dome but close tightly by the pressure from above when the flow relaxes and also by addition of a small weight attached to the flap as indicated. Thread the top flange into the bushing above and then fit a close 2-in. nipple into the bottom flange. It is best to force a ring into the upper end of the lower flange, to form a seat for the valve to rest on, if the 2-in. nipple does not come up flush with the flange. In any event, the ring will form the better seat.

The supply line consists of the following from right to left: One 1¼-in. 45° elbow and a 1¼-in. tee with 2-in side opening, connected by a 1¼-in. close nipple. A long 1¼-in. nipple connects the opposite end of the tee to a second 1¼-in. tee with a ¾-in. side opening. This second tee is then closed with a 1¼-in. close nipple and cap. Arrange the side openings in each tee in exact line and also in line with the 45° elbow. Thread the 2-in. nipple into the large tee and a ¾-in. elbow fitted with two close ¾-in. nipples, into the opening of the smaller tee. Point the elbow toward the cap.

If a ¾-in. safety valve is available it wall save some work, but if not, then a common ¾-in. horizontal check valve will suffice. Arrange the valve so that the gate closes toward the pipe end. The make and type of the check valve determine its installation. It may be found necessary to install it tilted, so that the valve will hang open until the pressure builds up suffi-

ciently to close it, or it may be found necessary to fit a spring to it to aid it in closing, or in staying open. Fig. 3, which shows how the spring may be fitted so as to be adjustable, is not to be taken literally, but only to illustrate the attachment of the spring, should this be necessary. The type of valve shown would not need a spring, in fact, it might be necessary to tilt the valve to make it stay open.

Mount the completed ram on two heavy timbers set at the fall. This latter can consist of a slight rapids, waterfall, flume or sations should be steady and constant. To start the ram, all that is necessary is to press inward on the check valve to open it, then permit it to close. After repeating this a few times, the ram should start operating automatically; if it does not, the fault is most likely in the check valve, and various adjustments should be tried, increasing or decreasing the spring tension, or the angle of valve tilt, until it does start. Should the ram become water-bound, it may be found necessary to drill a very fine hole through the 2-in nipple, below the



Any Handy Man Can Make this Hydrauiic Ram, Which Will Supply the House with Water at All Times without Labor or Expense, and with a Minimum of Maintenance

other means of conveying a quantity of water in a steady flow down a length of 1¼-in. pipe threaded into the 45° elbow. The ram can be secured by metal straps and should rest horizontally and plumb. Use red lead in all the joints, and paint it for security against weathering, if desired. When properly built and installed the pulvalve, to admit a small quantity of air with each stroke of the ram.

The ram may be housed in a pit, as indicated in the lower illustration, if necessary, to get the proper amount of fall.

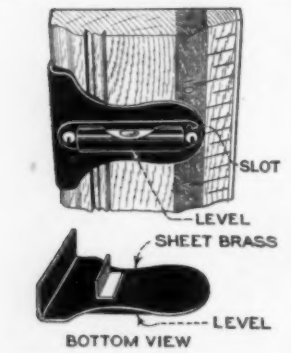
A strainer should always be placed in the inlet end of the drive pipe, to prevent the ram from becoming choked with dirt,

twigs, etc. It is also a good plan to surround this strainer with large wire netting, to prevent it from being choked also. Wherever possible, turns should be avoided in both drive and discharge pipes, and, where turns must be used, the elbows should be as large as practicable, so that there will be the slightest possible obstruction to the flow of the water.

Water can be used direct from the ram or from a storage tank kept filled by the ram. The latter is the more common method, as a large supply is always available. Water can be drawn from the tank as rapidly as desired for bathroom, kitchen, etc., and the water used when there is a large demand is replaced by the continually working ram when the demand is low.

Paperhanger's Level

In order to do a good job in wallpaper hanging it is necessary to get the first strip hung accurately; hanging the other strips will then be found comparatively easy. The customary method of doing this is to set a straightedge such as a trimmer up against the wall, level it with an ordinary carpenter's spirit level, and run a pencil mark on the wall along the straightedge. This necessitates carrying a large level around constantly just for this purpose, which means additional bulk and weight in the worker's grip, and is therefore not desirable. A much more convenient level, due to its small size and adaptability on the standard Ridgeway trimmer, is shown in the illustration. Such a level can easily be made by anyone who is mechanically inclined or it will cost only a few cents to have one made by a local tinsmith. The level consists of a small plate to which a spiri-level vial is attached. The plate is made of ⅛-in. sheet metal such as brass or copper, with one edge bent over at right angles and a short angle piece soldered onto the back as shown. It can then be clipped solidly in the groove and over the edge of the trimmer. Another piece of copper is bent to a cylindrical shape to hold the vial; this piece is soldered to a narrow strip, which, in turn, is riveted to the plate as indicated. The vial, which can be obtained at any hardware store, is cemented in the cylindrical sleeve with plaster of paris; this holds the vial securely and also provides a white background against which the marks on the glass and the air bubble inside can clearly be seen. The strip on which the vial is mounted is not riveted tightly to the plate, but one rivet is passed through a small slot cut in the strip, as shown, so that the level can be set accurately. The method of setting the level correctly is as follows: Clamp it on the trimmer and set the trimmer up vertically against the wall, using a regular spirit level to get it plumb; then if the small level does not read according to the other level, the strip is tapped lightly up or down as necessary.

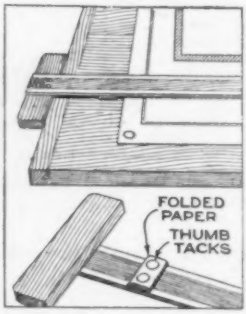


Etching Steel

One disadvantage of using nitric acid for etching steel is that the gas given off "lifts" the wax or other ground, causing very ragged edges on the lettering, if not making it unreadable. Another is that the fumes will rust near-by tools. These faults are not found in an etching solution of copper sulphate and common salt, made with equal quantities of fully saturated strength, and the solution is just as satisfactory as the acid.

Keeping Drawings Clean

An improved method of keeping a drawing from becoming soiled by the shifting of a long T-square, is shown in the drawing. Fold a sheet of paper a number of times to form a pad about ⅛-in. thick, and fasten it to the underside of the T-square, about 4 in. from the head, with two thumbtacks. When the draftsman places his hand on the head to shift the T-square, the weight of the hand will raise the straightedge from the paper; when the weight on the head is removed the blade drops down again.—Frank Harazim, New York City.

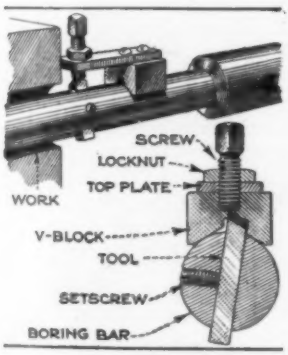


Preventing Decay of Fence Posts

A cheap, simple and effective method of preserving the ends of fence posts against decay is to char them. The ends are heated in a fire until the surface is well burnt and they are then immersed in water, with the result that a layer of charcoal about ½ in. thick is formed all over the surface. Charcoal is a form of carbon and, as carbon does not combine readily with other elements, it is very resistant to decay, protecting the wood underneath for a long time. Creosoting fence posts is, of course, an excellent method of preserving them, but is expensive and somewhat inconvenient, while charring the ends as described above can be accomplished anywhere and at any time, at practically no cost; it is only necessary to build a fire and have some water handy.

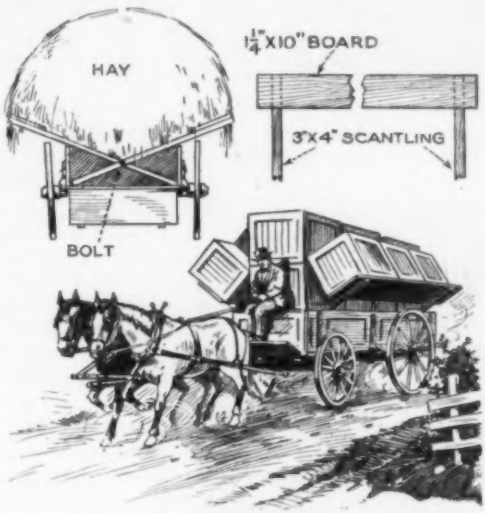
Gauge for Setting Boring-Bar Cutters

When using the boring bar, either on a horizontal boring machine or a lathe, it is often necessary to change cutters for different sizes of bores and counterbores, and much time is usually lost in trying to reset tools to just the right radius. Measuring the distance with a scale is slow and not very convenient. A handy little tool that has been found very satisfactory for resetting is shown in the illustration. The base of the tool is a 120° V-block, on top of which is mounted a plate that extends over one end of the block. A hole is drilled and tapped in line with the vee, and a screw is fitted, as shown, with a locknut. The bottom of the screw is perfectly straight and smooth and acts like a spindle of a micrometer on the straight face. Before removing a tool, which has sized a hole to its correct diameter, register the setting with the gauge by bringing the screw down so as barely to touch the highest part of the tool's cutting edge, and then lock the setting with the nut. Swing the screw point over the tool so that its center engages with the cutting edge as indicated. The tool can be made double-ended so that it can be used on two cutters.



Increasing Capacity of Small Wagon

Loads of merchandise, which are light in weight but large and bulky in size, can easily be carried on small wagons by providing two side supports of the kind shown in the drawing. The supports are made by nailing a 10-in. board to two lengths of 2 or 3 by 4-in. wood, as shown in the upper right-hand detail, and the supports are then arranged on the wagon box, as shown in the left-hand view, with the 2 by 4-in. legs crossing each other. The legs should be bolted together to keep the supports in position securely, so that heavy loads will not displace them. Large loads of hay and straw, and shocks of wheat, oats, etc., can readily be carried with the assistance of such a rack, and, as it is light in weight, it can be set up by one man.



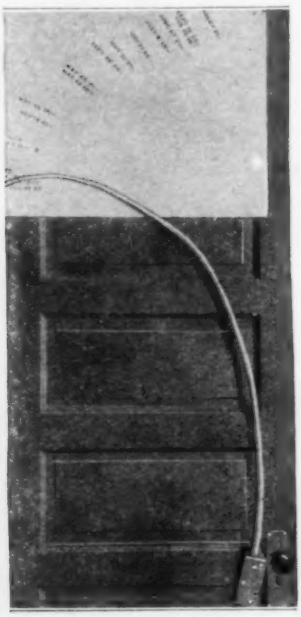
Side Supports on Small Wagon Increase Its Capacity for Holding Bulky Loads

Flume Lining

In order to reduce the water losses in a flume as much as possible we lined it with heavy roofing paper, sometimes called "rubber roofing." The joints of the lining were made waterproof by overlapping them about 3 ft. in the direction of flow. The weight of the water seals the joints and holds the paper securely in place and, therefore, it does not have to be nailed down. The inside of the flume should be fairly smooth, as pronounced projections will puncture the lining. A lining made of this material will last for several seasons if rolled up and protected during the winter. —Robert T. Pound, Lavina, Mont.

A Spruce-Limb Humidity Indicator

The photograph shows a spruce limb which is so sensitive to moisture changes that it might almost serve to indicate the humidity in the room where it is located. This limb is fastened to a door of the wood identification office of the U. S. Forest Products Laboratory at Madison, Wis. During the months when artificial heat is used the limb bends over to the left, and during the warmer months when the windows are kept open it straightens and extends nearly vertically. In the course of its gradual changes the tip moves through a distance of 30 in., describing an arc of about 80°. The dates along the arc show its position at different times for several years. The interesting action of this limb cannot be traced to any freak condition of growth, but rather to the normal presence of what is known as "compression wood" along the underside of the limb, and on the lower side of the leaning trunks of all coniferous trees. Situated as it is, this wood must act as a sort of prop or stiffening for the trunk or limb, and as a result it differs somewhat from the rest of the wood of the tree. It is the action of this kind of wood that causes the standing limbs of dead trees to curve downward during long periods of dry weather. It is harder than most wood, but the remarkable difference is that it shows considerable shrinking and swelling along its length with loss or gain of moisture, whereas normal wood shows almost no change in length.



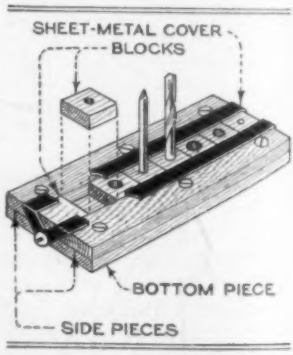
In the case of the limb shown in the photo, the compression wood shrinks and pulls it over to the position shown, when the air about it dries out, as when artificial heat is used. In the spring and summer when the windows are kept open the compression wood swells and this causes the limb to straighten out. Timbers or dimension stock that have been cut to include compression wood are very apt to bend excessively in seasoning and become worthless except as fuel. When they are weighted down in the pile so that bending cannot take place, enough tension is sometimes produced longitudinally to cause the wood to pull apart and show breaks or cracks across the grain—Forest Products Laboratory, Madison, Wis.

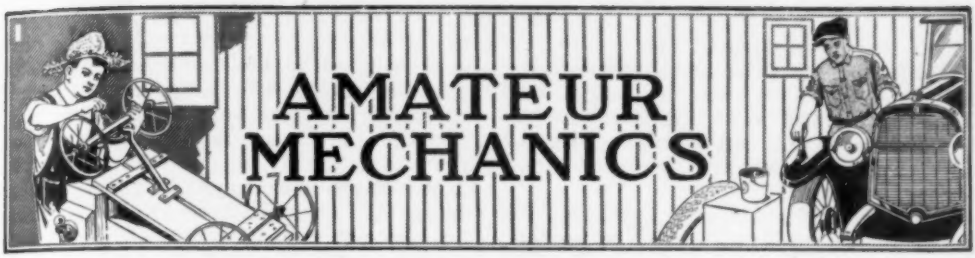
Improving T-Squares and Triangles

The edges of T-squares and triangles are always made vertical, and this makes it necessary for the draftsman to keep the side of the pen away from the lower edge to avoid getting the ink underneath it and smearing the work. A simple method of preventing this is to trim the edges of the triangles to a blunt V-shape. T-squares can also be improved considerably by gluing a strip of blotting paper or heavy drawing paper to the underside; this strip must be narrower than the width of the blade.

Tool Stand with Movable Holes

A tool stand of the kind shown in the drawing is especially useful around a drill press doing repetition work. It holds all the tools required on a job in a convenient manner and in the order in which they are used. Commonly a flat piece of wood is used for this purpose with a row of holes of various sizes, drilled to hold the tools, but this is in most cases rather clumsy because the holes being fixed cannot be adapted to suit the requirements of different jobs. The adjustable stand illustrated is made of wood and a piece of sheet metal. Two side pieces of wood are fastened with screws to a bottom piece, and a number of square blocks, drilled in the center with different-sized holes, are fitted between the side pieces. The blocks, when in place, are equal to the length of the stand, and are held in place by the sheet-metal cover, which is fastened to the wood by screws at each end.



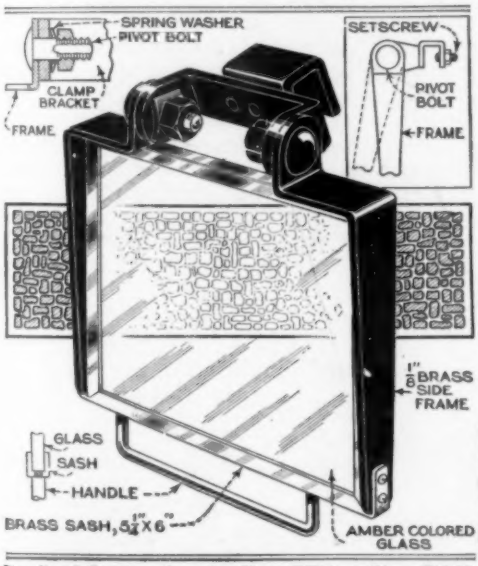


Making a Glare Shield

By J. V. ROMIG

MANY owners object to the type of glare shield that is fitted completely across the windshield. If of the adjustable type, they are unhandy in operation, and, if fixed, the driver must assume an awkward position when endeavoring to shield his eyes from the glare from the headlights of an approaching car.

The best type, to my mind, is the home-made one shown in the illustration, which swings up out of view when not in use. It is easy to make and operate, and is logically placed on the windshield frame.

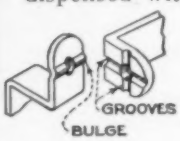


Details of Construction of a Very Efficient Glare Shield for the Automobile; Right, Shield in Use to Protect Driver from Headlight Glare

The shield is composed of a sheet-brass frame, ⅛ in. thick, cut to the shape indicated and fitted with a U-shaped sash, made of thin brass. The sash is soldered or riveted to the sides and top of the side frame and is made just large enough to enable the glass to be slid into place tightly. The sash may be lined with thin felt or rubber, cemented into place, if desired, to prevent rattle, but this is not essential if the glass is a good fit. The lower part of the sash is bent up at the ends and screwed to the ends of the side frame, so that glasses can easily be changed when desired.

For summer driving, an amber-colored glass is desirable, and for winter, a blue or green-colored glass.

The top ears of the side-frame members are pivoted to a clamp member, for the open car. This member is made of ⅛-in. sheet brass, bent as shown, and a lug that fits over the windshield frame is riveted and sweated to the back, as shown. The lug is drilled and tapped for ¼-in. steel setscrews, which fasten it to the frame. For the closed car, the clamp member may be screwed to the top frame, and the lug dispensed with; it may be necessary, in some cases, to make a special bracket to carry the shield in a convenient position. The ears of the side frame are bulged across in the manner shown in the detail, and grooves filed across the ears of the clamp bracket to fit the notches. The angle of the notches depends upon the position of the shield when up and down.



Spring washers are used under the nuts on the bolts that hold the shield frame to the bracket, and these force the bulges into the grooves, and hold the shield rigidly up or down. A substantial U-shaped handle, screwed to the lower sash member, completes the job.

When a car is seen approaching, the shield is snapped down, and, when the car has passed, a touch of the hand throws it up out of the line of vision again.

A Handy Stepladder

To avoid standing on tables and chairs when hanging pictures a useful stepladder can be improvised in a few minutes from almost any kind of stock that is available. The photograph clearly shows how it is constructed; if desired the platform may be hinged so that it can be folded down flat when not in use, and held up by means of a brace. In use, it is set up against the wall as shown. The feet of the ladder may be shod with rubber to keep them from slipping.—D. O. Woodbury, Boston, Mass.

White Covering on Stovepipes

In many up-to-date kitchens where the walls, woodwork, and wooden furnishings are enameled white, and the range and other metal is either enameled white or nickel-plated, a black stovepipe spoils the whole appearance of the room. There is no reason, however, why the stovepipe should be black. A simple method of changing it to match with the rest of the kitchen is to cover it with a layer of asbestos paper, and then apply a couple of coats of white enamel.

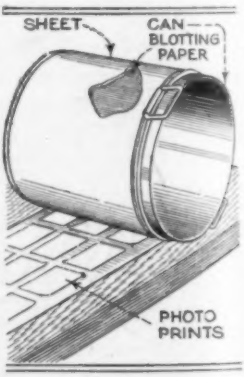
The asbestos paper can be pasted on the pipe with the paste used for wallpaper hanging, or, better still, by means of water glass (sodium silicate), which can be obtained at any drug store. The application of the paper around the bends in the pipe is not difficult if it is done correctly. The pieces should be wrapped around the bend, section by section, measured accurately, and then cut accordingly. The edges of the paper should not be overlapped, but should be butted together snugly. The first coat of enamel will soak into the paper, but the second coat will give a fair finish; a third coat is desirable to obtain a good gloss. The heat of the range, under ordinary conditions, will not scorch the enamel in any way; it will remain perfectly white except for the natural discoloration that is characteristic of all white paints and enamels.—J. E. Dekker, Chicago, Ill.

A Lattice Screen for the Garden

When it is necessary to repair worn-out spots on the lawn or to start new plants in bare spots a lattice screen has been found very good for protection. It is laid flat and is held just high enough above the ground by means of supports, one on each corner, to give the seedlings underneath head room, while protecting them against wind and sun and preserving the moisture in the soil. The construction of such a lattice screen is very simple. On a frame of 1-in. material, of almost any convenient dimensions, 2-in. strips are laid 1 in. apart. A frame of this kind will last a long time and when not in use need not be in the way, as it can be hung against a fence or wall, where it will require practically no space.—C. L. Meller, Fargo, N. D.

Novel Photo-Print Dryer

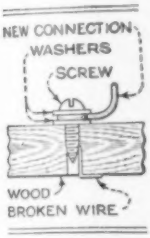
Novelty and simplicity are the outstanding features of the photo-print dryer shown in the illustration. The dryer was made from an empty peanut-butter can, although any other can having a similar shape can be used. It was covered with two layers of white blotting paper fastened by adhesive plaster. Then one-half of an old bed sheet, folded to fit the can, making three thicknesses, was wound on once and fastened by stitching it at the point of meeting, leaving a long



end on which the prints are placed. The prints are placed face down and the cloth is rolled on the can and tied, then, with the cover removed, the can is set bottom side up on a radiator. From 50 to 100 prints can be dried in a few minutes in this manner, and they come out perfectly flat and in good condition.

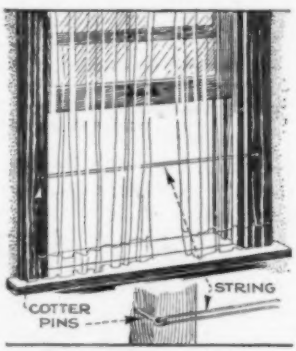
Repairing Broken Connections

It often happens that a wire is broken off where it comes through a hole and such a break is usually the most difficult kind to repair, without replacing the wire or adding a length. A simple repair that has been found effective is shown in the illustration. A small tight-fitting wood screw is driven snugly into the hole, the screw section wedging tightly against one bared end of the broken wire. Two washers are provided under the head of the screw and the other end of the wire clamped between them as indicated. This method cannot be used for repairing broken connections on wires that carry an appreciable amount of current such as house-lighting wires, and high-tension wires on automobiles, but will do nicely for low-current work.—Wm. J. Edmonds, Jr., Whitehall, N. Y.



Cotter Pins as Curtain-String Tacks

Ordinary cotter pins of small size can be used to advantage as a substitute for tacks on window casings, when used to hold a string across the sash in order to prevent the curtain from blowing outside and getting dirty when the window is up. A small hole is first drilled into the casing on each side so that the cotter pin will drive in tightly. The string or tape can then be slipped through the holes of the cotter pins and the ends tied together. The small, round, polished heads of the cotters look much neater than tacks.



A Dry Spot on a Rainy Day

It often occurs when out picknicking, that a little rain shower spoils the day, even if it does no more than soak the grass and

A Piece of Canvas, Tied to Trees, Provides Shelter for a Picnic Party During a Shower

prevent the party from sitting down on it. The shower need not, however, affect the picnic at all if a piece of heavy canvas is suspended between the trees in the manner illustrated, so that a sort of shelter is provided, under which the grass remains perfectly dry.

The canvas can be of any desirable size, and can be conveniently folded up and placed under the back seat of an auto. A brass eyelet is provided at each corner, to take the strain of the rope.—E. E. Hoppman, Dumont, N. J.

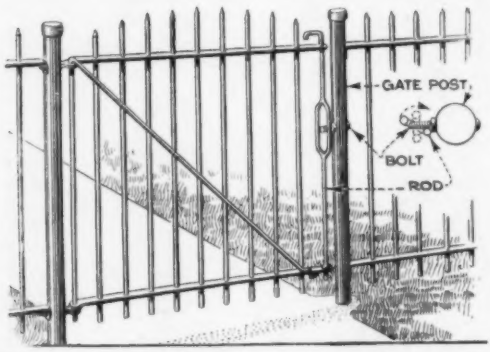
Mouse Trap Used as Cutout Spring

When connecting the muffler cutout on my car to the foot pedal I could not find a suitable spring to pull the cutout closed when the foot pedal was released. As a temporary method, which, however, proved perfectly satisfactory for permanent use, I used an old mouse trap, screwing it securely to the underside of the footboard and connecting the movable jaw firmly to a length of wire that was fastened to the foot pedal and cutout arm.—Harold Pinkerton, Pawnee City, Neb.

Automatic Gate Latch

Most automatic self-locking gate latches wear out in a short time and must be replaced, while the more durable kind must be opened and closed by hand.

The latch shown in the illustration is automatic, simple to make, and has no



Homemade Automatic Gate Latch that Cannot Be Released by Shaking or Rattling

delicate parts that are apt to be easily broken. It consists of an iron or steel rod, with a short piece welded on near the center to form an elongated O-shape as shown. A shoulder is formed at the lower end of the rod so that it will not slip through the crosspiece of the gate and the rod is bent at the top to form a handle. A hole is drilled through the gatepost and a bolt slipped through with a nut to hold it in place. The end of the bolt extends into the O-section, as shown in the detail, so that it strikes one side and gives the rod a quarter turn, thereby locking the latch. By examining the drawing, the action of the latch will easily be understood. The handle must be turned in order to open it.—L. H. Unglesby, Baton Rouge, Louisiana.

Using Discarded Double-Filament Lamps

The double-filament bulbs used on many cars are usually thrown away when one of the filaments is burned out. Although the lamp has a double-contact base it really has two one-wire lamps in the same bulb, each filament being connected to one contact and the other side grounded to the shell of the lamp base. To use these bulbs run a bridge of solder across the two terminals, and the bulb can then be used in the standard single-contact socket. The strength of the lamp will depend on which filament is the undamaged one.—John A. Blaker, West Auburn, Mass.

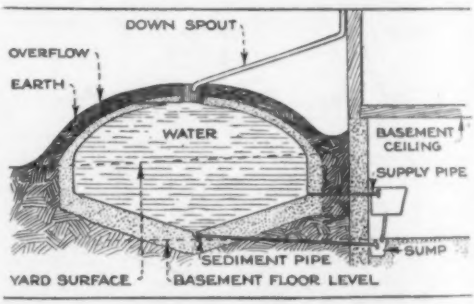
Keeping Pedal Pad Tight

Automobile pedals that are screwed on often have a tendency to work loose, and this is not only annoying but also dangerous. A good method of locking the pedal in place without going to the trouble of runing the thread down further and using a locknut, is to pack the screwhole half full of tough paper, and then screw the pedal down as tightly as possible. The resiliency of the paper will hold the pedal securely in place and prevent it from becoming loose.—G. C. Douglas, Raleigh, North Carolina.

Cistern Supplies Farm Laundry

On the majority of farms it is customary to use a small hand pump to lift rain water up from the cistern. However, if the water in the tank is above the basement floor, it is possible to provide running water for the basement, making the use of a pump in the laundry unnecessary.

The cistern is tapped for a 2-in. pipe, at as low a level as is possible to allow the water to flow into the tub. Two smaller pipes are connected to the 2-in. pipe, one for cold water and the other for hot water. The hot-water pipe is connected to the hot-water system of the laundry stove. The hot-water tank should be placed horizon-



Tapping the Cistern to Supply Water for the Farm Laundry in the Basement

tally and kept at a low level to assure free passage of water in case the pressure is very low.

If the ordinary cistern of 8 or 10-ft. diameter is not large enough the cistern should be built 12 to 20 ft. in diameter. It may be necessary to build the arch a few feet above the grade line, and in this case it should be cemented over and covered with dirt. A concave bottom brings the sediment in the center and this can be removed by opening the valve in a pipe, connected to the bottom for this purpose.—Jesse S. LaRue, Joliet, Ill.

Cutting and Drilling Glass

By I. CLYDE CORNOG

LIKE other processes, there are right and wrong methods of cutting glass, and the right method is usually the easier.

It is not necessary to have a diamond to cut glass; if one knows how to use it, a 10-cent cutter will last the average user a long time. Even the sharp corners on the end of a file can be used to cut glass. The secret of using a cheap cutter is to rub a cloth, moistened with kerosene, across the glass before trying to make the scratch. This takes off all the grease and permits a clean, continuous scratch to be made. Expert cutters often have a rag on one finger with which they make a streak across the glass before scratching. The same results are attained to some extent when the cutter is kept in a bottle of kerosene, although many people think this is done to keep it from rusting. The finer the scratch — and this is why a diamond is so satisfactory — the better the cut will be, but the scratch must be continuous and smooth. The rough edges of a poorly cut piece of glass may be ground smooth on an ordinary grindstone or emery wheel. Of course, the edge of the glass should not be held at right angles across the wheel, because it is apt to be broken this way.

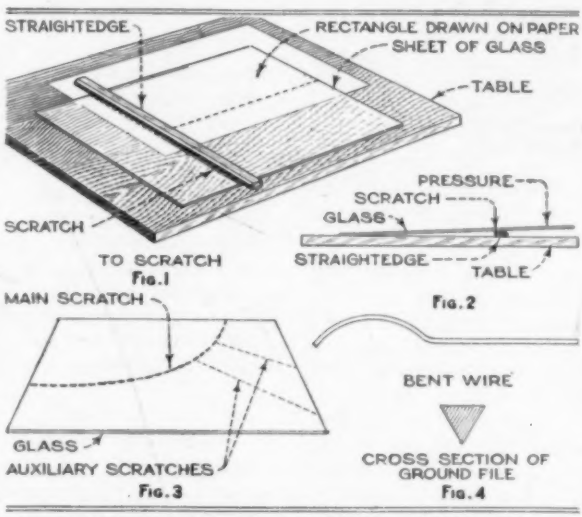


Figure 1: Proper Method of Scratching Sheets of Glass. Figure 2: Breaking the Glass at the Scratch. Figure 3: Cutting Curved Pieces. Figure 4: Bent Wire and File Used in Cutting Bottles and Tubes

If the cut is a good one, the edge may easily be worked with a file, almost as easily as brass, if it is first moistened with a solution of gum camphor in turpentine. This solution should be fresh and is made by dissolving as much camphor as possible in turpentine.

A good method of cutting a rectangle out of a larger sheet of glass is shown in Fig. 1. Draw a rectangle of the required size on a sheet of paper. Put the glass on this and lay a straightedge beside the line so that the scratch will be made directly above it. After the scratch is made turn the glass over and make another scratch directly over it on the other side. Pressure applied, as shown in Fig. 2, will now break off the glass evenly along the scratches. Proceed in the same manner with each edge separately. For large sheets, as, for instance, panes cut from ordinary window glass which is not perfectly flat, it is better to tap the glass with a narrow metal edge just under the scratch. Finally a crack will appear. This can be continued until it extends all the way across the sheet, when it will break easily. Even large sheets of plate glass will break readily when properly supported over an edge. Any straight, sharp edge serves for this purpose.

In cutting out a circle, or a piece having a curved edge, the main scratch is first made. Scratches are made running radially from this to the edge of the sheet, as shown in Fig. 3, and these are then tapped until the whole section not wanted is removed. The remaining piece may be ground smooth as described above. The most essential thing is a clean, fine, continuous scratch.

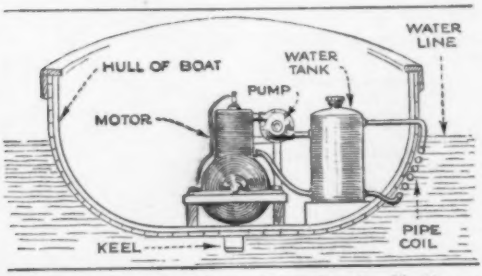
A hole can be drilled through a glass sheet by means of a short length of thin-brass tubing, rotated at about 100 r.p.m., and fed with a mixture of fine emery moistened with a solution of camphor in turpentine. The drilling can be accomplished by means of an ordinary drill press, care being taken, of course, not to apply so much pressure that the glass will break, as this is essentially a grinding process.

A bottle or large glass tube may be neatly cut by bending a length of iron wire, about No. 10 or 12, to the curvature of the tube, as shown in Fig. 4, leaving enough

for a handle. Heat the wire until it is red and apply it to the tube. In about a minute the wire is removed and a drop of cold water is placed where it touched the glass. The glass will usually crack off straight along the line where the hot wire touched it. A fine scratch around the bottle, made with an old triangular file, often helps do the work.

Cooling System for Boat

In rivers where the water is heavily charged with sand or other substances that cause trouble with the water pumps and cooling systems of motor boats, the novel



Cooling System for Boats Operating in Muddy or Sandy Waters

cooling system shown in the drawing will be found to be of considerable value.

In this system the water is not taken directly from the river, but a metal tank is kept filled with clean water, which runs through the cylinder jacket and also through a cooling coil attached to the outside of the boat, under the surface of the water. Such a cooling system can readily be installed in any boat that is used in sandy or muddy rivers, where the cooling system of an ordinary marine engine is likely to become clogged and the pump damaged by foreign material in the water.

Coloring Oranges

Citrus fruit may be mature and highly desirable for food while the skin is still green. This is especially true of the Satsuma orange, one of the so-called "kid-glove" variety belonging to the tangerine family as grown in Alabama, where the fruit frequently reaches the palatable stage some weeks before the skin attains its characteristic golden color. If left on the trees the fruit deteriorates, yet, in the mind of the public, a green-colored orange is unfit for food. This condition has led to the perfection of a coloring process based on experiments with lemons in California by the bureau of plant industry of the U. S. dept. of agriculture, a process that gives the fruit the right color without injuring its food value in any way or adding harmful ingredients.

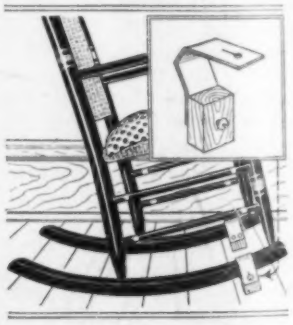
After the fruit is graded it is placed in airtight rooms and subjected to fumes from kerosene stoves or the exhaust gases from a gasoline engine. These gases destroy the green chlorophyll that masks the yellow color of the oranges. Fruit carrying up to 40 per cent of its natural ripe color will ordinarily require about four days in the coloring room to develop its full-ripe color. This process saves the grower from four to six weeks and enables him to get the fruit on the market much earlier than would be possible otherwise. —A. C. Cole, Chicago, Ill.

Nickel-Plate Preserver

An excellent preservative for nickel exposed to the weather, such as the plated parts on automobiles, can be made from ½ oz. of camphor gum, 1 oz. of powdered graphite, and 2 oz. of mutton tallow. The camphor gum is cut to fine shavings and added to the heated mutton tallow, and both are thoroughly mixed. Allow the mixture to cool until lukewarm and then add the graphite. Stir until it assumes the consistency of a thick paste. By using it once or twice a month the nickel parts will never corrode, but will always look bright. —Mrs. A. K. Hinkley, Rowley, Mass.

Adjustable Blocks for Rocking Chair

Many rocking chairs can be made much more comfortable by the addition of the simple devices shown in the illustration. Two wooden blocks, about 1 by 1½ in. in dimensions, with the widest part on the bottom, are attached to the rocker, as shown, by means of pieces of inner-tube rubber, so that they can easily be slid back or forth to hold the chair at any angle desired. If it is desired to use the chair as a rocker it is only necessary to slip the blocks over the ends, thus bringing them on top.—J. H. Shadek, Gradell, New Jersey.

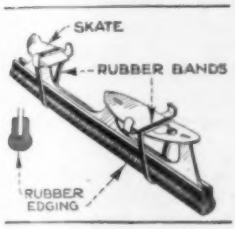


First Aid for Wounded Trees

When a considerable portion of the bark around a wounded tree is knocked off the tree is very apt to die. This can usually be prevented, however, by dressing the wound, that is, by cutting down the ragged edges and giving the exposed portion a liberal application of melted paraffin.

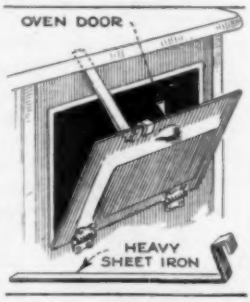
An Ideal Skate Guard

The windows and windshields of many cars are fitted with lengths of slotted-rubber edging so that the window will fit snugly in place. This edging, which can be obtained at any auto-wrecking yard, has been found very useful for making guards for the runners on skates, as the runners just squeeze snugly into the slots. Cut off lengths about an inch or two longer than the skate runner and then bind them to the skate by means of a couple of rubber bands on each so that they will not accidentally drop off. With these guards in place the skater can walk from one pond to another, over stones and other obstructions, without danger of injuring the fine-edged blades.



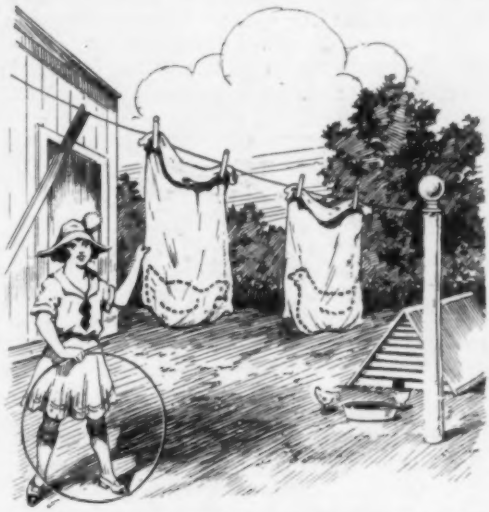
Holding Oven Door Open

It is dangerous to leave the oven door of the range open as one is liable to receive considerable injury by stumbling or bumping against it. Still it is often necessary to allow the heat inside to escape. The illustration shows how this may be done without the above-mentioned danger. A strip of heavy sheet iron, 1½ in. wide and 8 in. long, bent to the shape indicated, is all that is necessary. The bent end is hooked over the top edge of the oven door and the other end placed against the side of the stove, under the edge of the top, as shown. The spring of the oven door will keep it securely in position.—Miss Grace Robey Schoettler, Buda, Ill.



Discouraging Broody Hens

Hens may be completely discouraged from wanting to set by placing them in sacks and hanging these on the clothesline,



A Simple Method of Preventing Hens from Setting, Requiring No Extra Pens

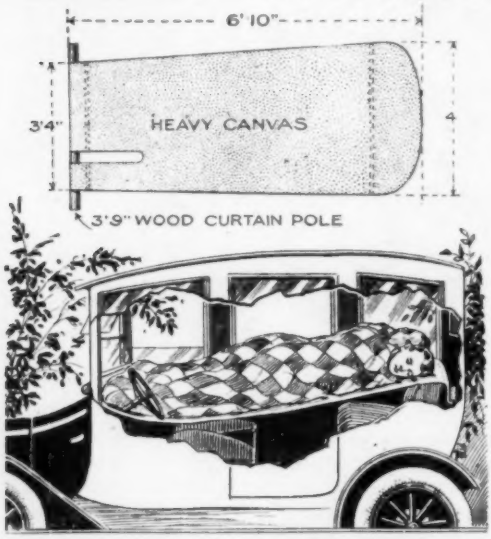
as shown in the drawing. This method usually effects a cure in about three days, and even the most stubborn hens will yield in four days. The sacks should be as thin as possible to allow free circulation of air. Common burlap sacks, loosely woven, are excellent for this purpose. A New Hampshire farmer who used this method instructed his children and the hired help to give the sacks a swing every time they passed under the line to make it still more uncomfortable for the hens.—James F. Hobart, Dunedin, Fla.

Stopping Leak in Cistern

A troublesome cistern leak that allows water from the outside to seep in can be stopped very easily by first making a 6-in. opening through the cistern wall where the leak is located, and then, by means of a small trowel or dipper, manipulated through this opening, digging a small hole in the earth outside to retain all the water that would otherwise leak into the cistern in 15 or 20 minutes. The water is dipped out and the hole in the wall is cemented shut with two hot bricks and mortar. The bricks must be hot so that the mortar will set fast enough to prevent the water from washing it away. This repair is very effective if the leak is not too large.—Nathan R. Baker, Westport, Ind.

Sleeping in Ford Sedan

When traveling or camping it often becomes necessary to sleep in the car, and those who have done this will admit that it is not very comfortable unless special arrangements are made. In the case of a Ford sedan, or similar light car, a comfortable stretcher can easily be installed so that it is ready for use at any time. The



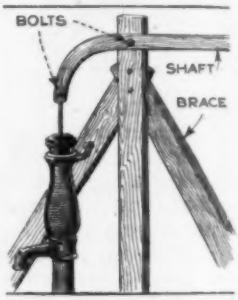
Canvas Stretcher Installed in a Light Sedan Adds Considerably to Travelers' Comfort

back cushion is removed by taking out two wood screws at the bottom of the frame just above the tool box, and lifting upward with two fingers inserted in the finger holes at the center. This movement unhooks the back from the strap located at the center near the top, and allows the cushion to be removed without any difficulty, exposing a large storage space. A heavy strip of wood, which forms part of the body frame, extends across the back behind the cushion about 6 in. below the top. To the underside of this strip is nailed the wide end of a doubled piece of heavy canvas, cut according to the dimensions given in the detail. The double thickness of the material at this point assures ample strength for fastening. At the other end of the canvas a slot is cut to pass over the steering-wheel post, and a 3-in. hem is made to take a length of 1½-in. curtain pole, 3 ft. 9 in. long. All seams are double-stitched with heavy thread.

In making up this bed the folded canvas is taken from its storage place behind the cushion frame and brought forward over the lowered backs of the two front seats to the windshield. The lower portion of the windshield is opened outward and the curtain pole passed through the hem, the ends bearing against the outside of the window frame on each side, as shown in Fig. 2. If proper tension is given, the canvas will not sag enough to touch the front seats and will be sufficiently high at the back so that no pillows are needed. During the day the canvas is folded and stored behind the back cushion, and the curtain pole placed under the rear seat.

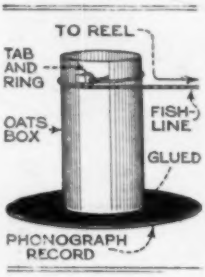
Pump Handle Made from Buggy Shaft

A pump from which the handle, rocker arm, and handle fulcrum had been broken accidentally, was repaired by means of an improvised pump handle consisting of an old buggy shaft cut off about 5 ft. from the bent end. Two holes were drilled through at the points indicated so that the shaft could be bolted to the plunger rod of the pump and to a fulcrum, which was made by inserting a post into the ground just behind the pump. This post was solidly braced and a hole drilled through it about a foot above the pump collar; the shaft was then bolted on loosely.



Drying Fishing Lines

Wet fishing lines rot rapidly; it is therefore not advisable to keep them on the reel, but they should be wound on a drier of some kind, and a simple homemade one is shown in the illustration. It consists of a cylindrical paper box such as a large oatmeal box, glued onto an old phonograph record as indicated. A tab with a ring in it is glued to the box at one end to provide a place to fasten the end of the line. Place the record on the phonograph and start the motor; this enables the line to be wound from the reel to the box in a very short time without any trouble.—W. T. DeWolfe, Toledo, Ohio.

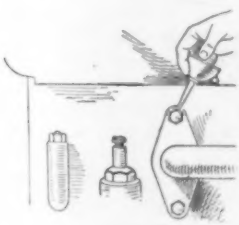


THE SPRING OVERHAUL

By B.M.Ikert
TECHNICAL EDITOR
"MOTOR AGE"

Part I

SPRING is the accepted time for administering the yearly inspection and touching up of the car. Just how much work is necessary to condition the car for another year's work is governed entirely by individual conditions. The same can be said regarding who shall do the work, as individual mechanical ability varies through very wide limits. A good rule to follow is: "Be sure you are right and then go ahead." In other words, if you have never scraped a connecting rod or main bearing don't experiment on your car but call in a man who is capable. Every man has some latent mechanical ability, and the things covered in the following paragraphs are directed to the one who has ordinary mechanical intelligence and ability. The night before you start the job, give those bolts and nuts that look rusty a good soaking with penetrating oil. If you can't buy penetrating oil in your town use kerosene first, and two hours after the kerosene has been applied follow with a similar amount of engine oil. The bolts likely to be rusted or stuck are those on the exhaust-pipe header and all those located under the chassis, where mud and water get in their work. Before doing any work go over the whole car and jot down in a notebook the parts needing replacement or repair, including the top and body. These notes will record work and material necessary, and as far as possible all repair parts should be on hand when the great job of cleaning begins. After deciding just what is to be done, map out a mode of attack and stick to it as far as possible. The work must be done in a systematic way. It is wrong, for instance, to clean a small portion of the engine or chassis, make an adjustment on the brakes, and then jump to some part like the ignition system.



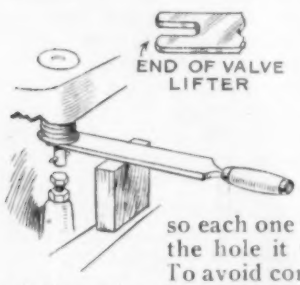
Wash all grease and mud from the exterior of the car and do an extra good job of it. Kerosene is efficacious in places where the ordinary oil or body soap will not cut the deposits of grease. Do not stop with cleaning the exterior and underpart of the chassis, but include the engine exterior and all parts in the engine compartment. A stiff brush of steel bristles is good for cleaning the heavier deposits on the engine and metal parts, after which the job is completed with a cheap paint brush and kerosene.

An assortment of small boxes or tin pans is a necessity for holding the small parts that you will remove from the car during the course of the repair operations. This, however, does not mean that all parts are to be put into the small boxes. The safest rule to follow is to put all bolts and small parts back into their respective positions after the unit or part has been removed from the car. If you take the generator off its mounting, screw the holding-down screws back into the base of the generator, putting the lock washers on the same way as they were taken off. The same applies to the removal of any unit or accessory. Two of the most useful tools the owner will use are a light machinist's hammer and a prick punch. These will be used for marking parts before they are removed. Suppose you were to take off the connecting-rod caps and got them all mixed up. You could not tell which was No. 1 or No. 4, and even if you did you might bolt them on in the

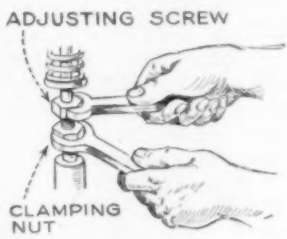
reverse position. To guard against this a mark is made on the connecting rod proper and connecting-rod cap. For No. 1 rod a single mark is made, for No. 2 two marks, and so on. Both marks are made on the same side of the rod, thus when the bearing cap is removed and replaced there is positive assurance that everything is correct. In the case of bearings, both main and connecting rod, it is necessary to remember that all marks face the camshaft side otherwise the markings will not prevent the caps being reversed on the crankshaft. If a real job of marking is desired the owner may purchase a set of steel letter or figure stamps. Numerals make identification of parts absolutely accurate, and only one character need be stamped on mating pieces.

We will assume that the engine has been thoroughly cleaned on the exterior surfaces. The next step is to clean the engine internally, which will include the removal of carbon, and cleaning and flushing out of the oil pan and lubricating system. Starting at the top of the engine, begin with the removal of carbon and the grinding of the valves. Generally speaking, the procedure is as follows: Drain the radiator, and disconnect all water and oil connections to the cylinder head. Remove spark plugs and any wiring, which should, of course, be tagged. The cylinder-head screws or nuts are now removed and the head lifted off. The engine is turned so that all pistons are successively in position for carbon scraping, which is accomplished with a putty knife. Clean the tops of the pistons and other parts of the cylinder block, but do not spend any time on the valve heads.

It is an easy matter to grind valves, the hardest part being the removal of the pin or split washer placed under the lower valve spring washer. It is necessary to bring each valve to the fully closed position before attempting removal of the retaining key or split washer. A valve lifter that will work on practically all automobile engines can be purchased for less than $2, so do not attempt to use files, screwdrivers, etc., which usually result in skinned knuckles. In taking out the valves be sure to lay them down in proper order so each one will go back into the hole it was taken from. To avoid confusion, the head of the valve is very lightly marked with the steel stamp, making sure that the valve is seated at the time of marking, otherwise damage will be done the valve head. A safer method is to lay the valves on the bench in the order of their removal. A sheet of wrapping paper laid out in sections marked 1, 2, 3, 4, and so on, up to the total number of valves, provides a method of identification without actually stamping the valves. After removal of the valves any remaining carbon on the cylinder head and block is thoroughly scraped and then the valves themselves are cleaned. The finishing touches of the valve-cleaning operation are given by using a piece of emery cloth to remove the final vestiges of carbon. When this is done, turn to the valve tappets for the next work.



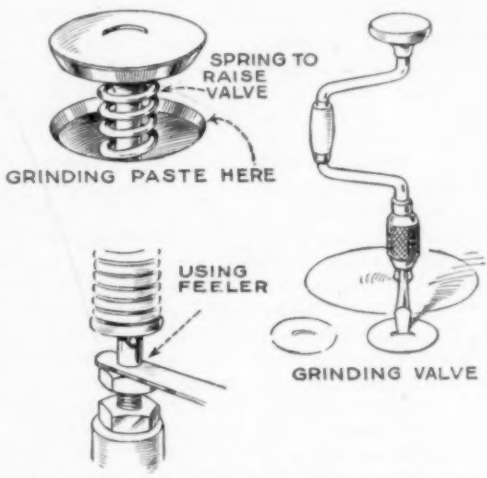
Practically every engine except the Ford is equipped with adjustable-valve tappets. These tappets, which are locked by means of a nut and locknut, should be slacked off about two turns so as to allow enough clearance between the valve stem and the tappet screw when grinding. Slacking off the tappets necessitates the use of two end wrenches, one to hold the tappet from turning, and the other to loosen the locknut. It is now time to examine the valve stems and valve guides in the cylinder block. Should the diametral clearance between the valve stem and its guides exceed .006 in. the valves should be condemned and a new set with oversize stems should be fitted. It will be necessary in this case, of course, to secure a reamer of the desired oversize, and with this tool the valve guide will be reamed to a diameter about one and one-half thousandths larger than the valve-stem diameter.



Examine the valve seats, and if they are only lightly pitted regrinding will put them in shape. Should there be decided rings or very noticeable pitting of seat or valves it will be necessary to resort to the valve-seat reamer. If you are not familiar with the operation of these reamers—and they are more or less costly—it is advisable to call in an experienced mechanic to do the reseating. Valve grinding itself is a simple operation, and requires besides the paste or compound a screwdriver or valve-grinding tool to oscillate the valve back and forth. A brace fitted with screwdriver bit, or a bit of the shape required for the particular valve, is used and does the work very well.

Do not attempt to make your own grinding compound but purchase it from the supply store. The procedure when grinding is about as follows: With everything nicely cleaned take the first valve, or No. 1, and put a little of the grinding paste on its face. Place a small coil spring under the valve head and drop it into place in the guide. The spring best suited will be one that will just lift the valve when pressure is removed from the valve head. In grinding, do not use a continuous rotary motion, but turn the valve a half turn or so, first in one direction and then in the opposite. Remove the pressure occasionally, and as the valve lifts, turn it to a new position. Constant reversal of the movement and constant raising of the valve during the grinding will prevent the formation of deep grooves on the valve face and seat. Bear down on the valve just enough to cause the paste to grind. Do not grind any more than necessary and as soon as the valve becomes shiny and no pits are visible, test it for holding qualities. The test is made by applying a very thin coat of Prussian blue to the valve face. The coating should cover the entire face, and the valve should then be placed into its proper guide in the cylinder block. On this test the valve is given all the pressure that can be exerted, but it is turned only ⅛ in. on its seat. This rotation should transfer the blue from the valve to the valve seat on the block. It is not necessary that all the blue be transferred, but there must be an unbroken line of contact of the blue on the valve seat. When a valve will pass this test it is ground to a satisfactory seat. After the valves have been ground they may be replaced, at which time the stems are given a thin coat of oil made into a thin paste with very fine graphite. This is to prevent sticking of the valves, due to a lack of lubrication.

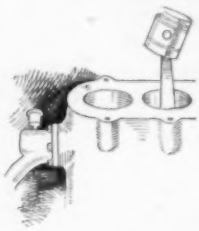
With the valves in place it will be necessary to reverse the removal operations concerning the springs, etc., and the valve lifter will be again brought into play. When all valves are in and springs and locks installed the next step is to set the tappets to the recommended clearance. A rule that must be followed when setting tappets is as follows: Set the tappets by turning the engine so that the pushrods for that particular cylinder are at the lowest point of their travel. With both pushrods in this position the engine is turned so that the piston is approximately at top-center position. After turning the engine be sure that the pushrods have not been raised because it is necessary that they be at their lowest point at the time the tappets are being adjusted. The procedure as outlined is applied to each cylinder separately and in order. For engines installed in cars manufactured since 1920 the average tappet clearance will be about .004 to .005. Exceptions to this average are all valve-in-head engines, which generally are given about double this amount of clearance. Always set the tappets on a valve-in-head engine when it is cold. For both types of engines it is advisable to make use of a thickness or feeler gauge when setting the tappet clearance. Should it be impossible to secure one of these gauges an ordinary sheet of writing paper will suffice. Ordinary paper is about .005 in. thick and to get the proper clearance it should be a fairly close fit between tappet and valve stem. Some resistance should be felt when removing the paper if the clearance is correct. The same applies to the feeler gauge, although the metal gauge should be a little tighter than the paper.



Details of Valve-Grinding Operation, and Tool Used; Below, Adjusting Tappets

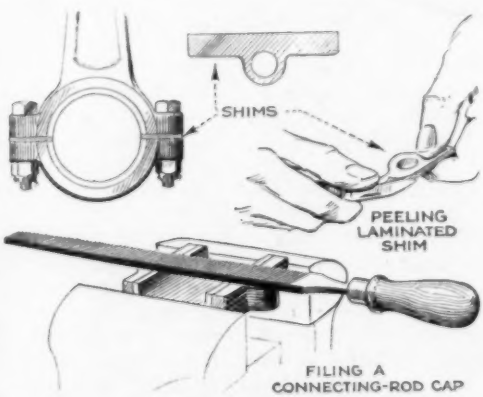
Where a car has been driven in excess of 15,000 miles it is advisable to remove the piston and rod assemblies for inspection and possible repairs. The first step consists in draining the old oil from the crankcase and then removing the oil pan or lower crankcase assembly itself. There are three makes of cars that necessitate the removal of the cylinder block in order to remove the connecting rods, they are the Hudson Super Six, the Monroe, and the Packard single six, of early model. All other cars manufactured since 1918 are so constructed that removal of the rods can be

accomplished without disturbing the cylinder block. The next move will be to mark the rods for identification. With this done, remove the cotter pins and nuts from the rods and pull the assembly up through the top of the engine. Be sure that the bearing shims are not disturbed, and, to insure against a mixup from this source, it is recommended that the shims, cap, and bolts be replaced on the end of the rod immediately after the rod has been disconnected from the crankshaft. A comparatively new development in the automobile industry is the shimless bearing. Should the engine on which you are working have bearings on which there are no shims it means the bearings are either nonadjustable or should be adjusted by filing the bearing caps. Generally speaking, a satisfactory job of filing cannot be done, and even the car manufacturers recommend that instead of adjustment the bearings be replaced with new ones.



In removing the pistons be careful of the rings. They are broken easily if handled roughly and the same can be said of the modern piston itself, which is usually so thin that a blow or even a squeeze of the hand will throw it out of shape. Now examine the rings and grooves, and note whether there is any up-and-down play in the piston-pin bearings. Do not be misled by the lateral play of the rod on the piston. This is necessary and should not be mistaken for wear.

If no socket wrenches are available the piston-pin locking screw in some cases can be removed with an ordinary double-ended wrench. In this case place the end wrench on the screw and with a monkey wrench as a handle operate the two as if the end wrench were a socket. Should the pistons and rings be of a dark color it shows that they have not had a full contact against the cylinder walls. Any dark spots on the face of a ring are sufficient evidence to condemn that ring, and a new one should be installed in its stead. The rings should be a rolling fit in the piston-ring grooves. Any clearance between the ring and the groove in excess of .002 in. is sufficient to condemn the ring or piston, depending on which part is worn. Generally speaking, if the piston rings were originally installed in the correct manner any ensuing wear will be mostly on the piston, which means that the piston should be replaced. Always bear in mind that there is more leakage past the back of the ring than past the face. It is for this reason that ring-gap clearance is not nearly as important as a proper fit in the grooves.



Lower Connecting-Rod Bearing, Showing Shims; Below, Filing a Cap

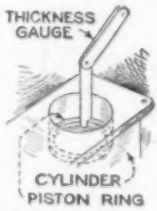
To remove the rings proceed as follows: Cut several strips of ordinary tin or use pieces of old hacksaw blades, annealed. These strips will be about ¼ in. wide and about 5 in. long. Slip one of these strips under the first ring at the joint and work it around back of the ring to a point about opposite the point where it was originally inserted. Proceed carefully, as the rings are fragile and easily broken. Place two or three more strips behind the ring and work them around so that they are about equally spaced. There should be a strip directly behind each end of the ring. By this time the ring will be free from the groove, so that with the fingers the ring can be worked up on the guides until it slips off the piston. We will assume that the rings need replacing, but that the piston is in good shape. In this case clean the ring grooves with a narrow chisel or screwdriver and finish with a wire brush dipped in kerosene. Apply the same cleaning to the piston itself, using kerosene and a little crocus cloth to remove any roughness of the piston faces. Then lay the pistons aside for use when fitting the rings. In fitting new rings it must be remembered that the top ring is nearest the combustion chamber and operates at a higher temperature than the lower ones. It is for this reason that the top ring is given greater clearance at the gap than any of the others. A good rule that will apply to all engines of less than 4-in. bore is to allow .006 to .008 in. clearance at the slot or gap. The second and third rings should have a clearance of not less than .003 in. and not more than .005 in., the lesser clearance being desirable. The owner cannot afford to

guess at the clearance, for it is far too delicate to be gauged by the naked eye. A feeler or thickness gauge must be used. Merely taking any ring that comes to your hand and filing the slot clearance so that it looks approximately right is no assurance that you are going to improve the compression or eliminate smoking of the engine. The new rings will need fitting into the grooves in the pistons. If they are tight they will not be free to expand when heated and will either wear excessively or cause a scored cylinder. If they are loose the compression and oil will leak behind the ring and a lack of power, and smoking, will be the result. A piece of fine emery cloth glued to a flat piece of hardwood, or, better still, to a piece of plate or thick glass, can be used to reduce the thickness of the ring. Rub the ring over the emery cloth with a rotary motion, so as to reduce it to equal width all over. In fitting to the grooves, the rings should turn freely with the fingers. There should be no actual clearance that you can measure, but they should be fitted with what is known as a sliding or rolling fit.

Rings should be replaced in the order in which they are removed, that is, the slots of the upper and lower rings should point in one direction, while the slot of the center ring should point in the opposite direction. Mark the upper ring so that in replacing after fitting you will put the right ring in the right groove.

Never replace the original piston rings with new ones unless they are worn or have not been making full contact against the cylinder wall. If an old ring is worn more than .010 or .012 in. it is cheaper to replace that ring at the time when the engine is being repaired than take the chance of having to tear the engine down for a second repair. If you have difficulty in squaring up the rings in the cylinder bore to test for the slot clearance, use the piston to keep them straight. In other words, after letting the piston down into the cylinder, enter the ring and then push the piston up again so that it bears against the ring and lines it up. If the ring is slightly "cocked" in the bore you cannot measure the slot clearance with any accuracy.

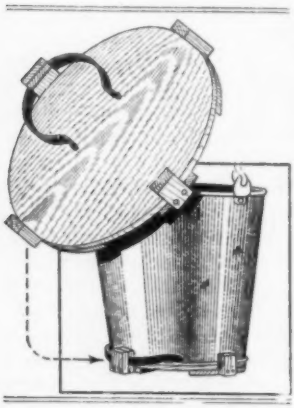
In measuring the clearance of rings that are assumed to be excessively worn, bear in mind that .001 in. wear on the cylinder bore equals .00314 in. increase in the circumference. Thus a ring originally fitted with .006 in. clearance will have at least .012 in. when run in, because it will have worn at least .002 in. before it polished up thoroughly. With this in mind the reader can see that accuracy of workmanship is absolutely necessary for results on this operation. When you have fitted each individual ring to its particular groove and have adjusted the slot clearance for each ring by fitting into the cylinder bore and filing to the correct slot distance between ends, the rings are then ready to be applied to their respective pistons. The steel strips will be used for installing the new rings onto the pistons, but do not fasten the rods to the pistons until later. With the piston out you can readily detect any shake in the main or camshaft bearings. If the camshaft bearings are loose they must be replaced, as they are not adjustable. As a rule the camshaft can be removed by loosening setscrews on the side of the crankcase, which hold the bearings in place. To facilitate matters raise the pushrods to their highest point and block them in position. On some engines the entire pushrod assembly can be removed in a few minutes and this is recommended as being better than blocking the pushrods. With pressure on the camshaft thus removed the camshaft and gear usually may be removed as a unit. This does not hold true with every engine, but a little study will determine the method of removal on the various installations. Because the camshaft bearings will show less wear for the same mileage than any of the other engine bearings there will be no necessity for its removal except in very unusual cases, as when lubrication has been neglected, or oil pipes choked.



(To be continued.)

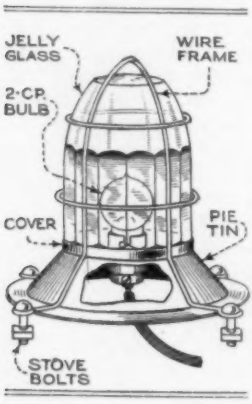
False Bottom Keeps Pail Clean

After trying in vain to keep the bottom of the milk-pail free from the mire of the barnyard, a false bottom was devised as shown in the drawing. A round piece, ½ in. larger in diameter than the bottom of the pail, was cut from an apple-box side (any similar lumber would do, of course). To this were nailed three lath cleats, across the grain. The middle cleat was allowed to extend 1½ in. beyond either edge of the board, and to these extensions were nailed two 1½-in. blocks cut from 1-in. lumber. To one of these blocks was fastened a spring trousers-guard such as is used in riding a bicycle. The spring was held solidly in place with a lath wedge. Two small lath uprights nailed to the sides completed the job. The spring holds the false bottom firmly in place.



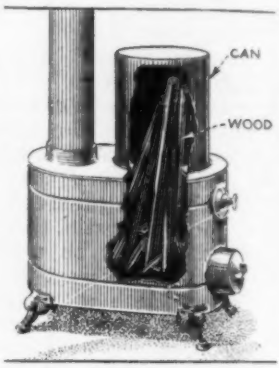
Homemade Running-Board Lantern

The small running-board lanterns now used extensively on automobiles cost from $5 to $10 each and quite a saving is made by making a pair, which has been done at a cost of 59 cents each. Each lantern consists of a pie tin of small size, black enameled, a frame made of heavy galvanized-iron wire, a tin-can cover of the same diameter as the bottom of the pie tin, and an ordinary automobile lamp socket. The socket, cover, and pie tin, and also the wire frame are all neatly soldered together. The ends of the vertical legs of the wire frame are formed into eyes to take small bolts which are used to attach the lantern to the running board. The cord connected to the lamp socket is brought through the running board through a hole drilled directly below the socket. An ordinary jelly glass, colored red or green on the inside, is placed over the bulb, fitting exactly inside of the wire frame. The glass is colored with the solutions sold for coloring Christmas-tree lights.—M. Mather, Chicago, Ill.



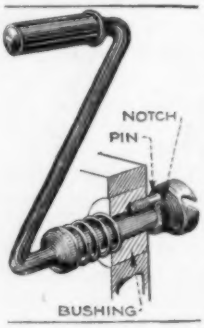
Using Long Wood in Stove

Small sheet-iron stoves of the kind shown in the illustration require wood cut to short lengths, about a foot long, which necessitates considerable chopping and cutting. A good method of increasing the capacity of the stove so that it will hold longer pieces is to substitute a large can or pail for the lid on top. The can is inverted so that the longer pieces of wood will extend into it. The wood projecting into the can will not burn to any extent owing to the lack of oxygen, but it will gradually burn away at the bottom. The can also serves as an excellent radiator of heat.—V. A. Lyman, Casmalia, Calif.



Keeping the Crank from Swinging

The illustration shows a simple catch to hold the starting crank of a light automobile from swinging and also to keep it out of the way of splashed mud. The only thing necessary is a ¼-in. steel pin. This is attached by threading one end and screwing it into a hole drilled and tapped in the rear of the bushing through which the crank is inserted. A slot is made in the hub of the crank ratchet to engage the pin. The spring on the crank pushes it forward and the pin enters the slot as indicated, keeping the handle in position.—G. A. Luers, Washington, D. C.

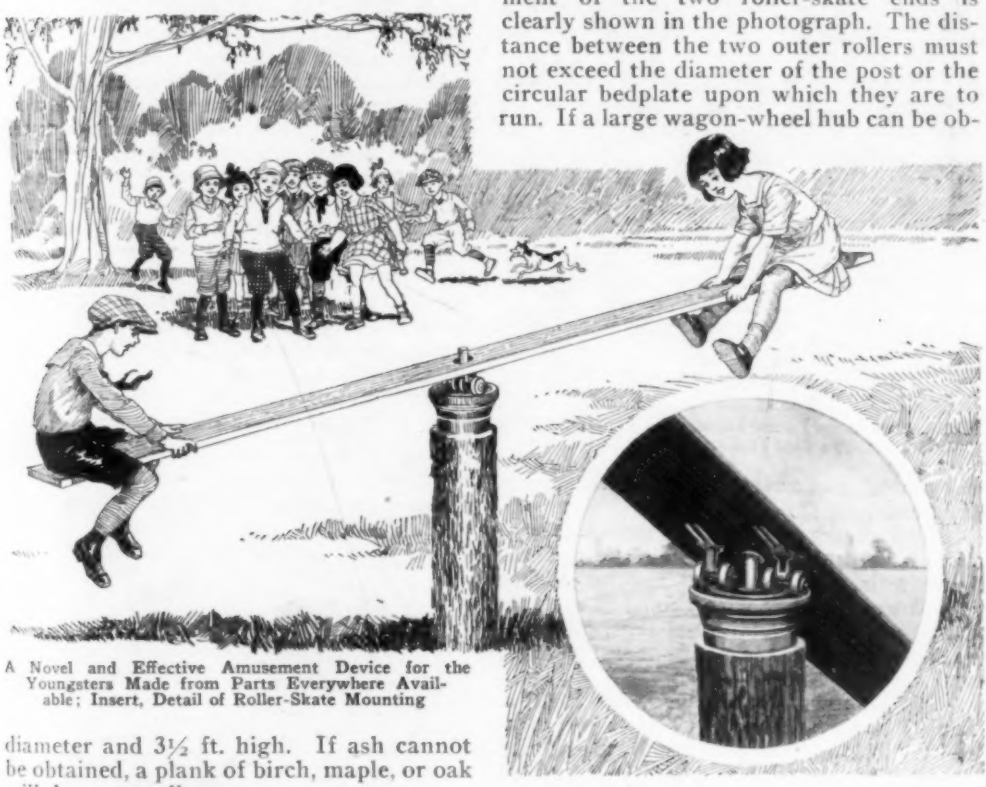


A Seesaw Merry-Go-Round

By HARRY D. TIEMANN

A LOT of fun can be had with the teeter-totter merry-go-round shown in the illustration, and any boy can make it who is at all handy with carpentry tools. If built substantially it will amuse the youngsters, big and little, for years. It will go up and down like a seesaw and spin around like a top until the passengers are dizzy.

All that is needed is an old pair of roller skates, a piece of 1-in. pipe, 18 in. long, a good ash plank about 1½ in. thick, 12 in. wide, and as long as possible to get it, and a solid post or tree trunk, about 1 ft. in diameter and 3½ ft. high. If ash cannot be obtained, a plank of birch, maple, or oak will do very well.



A Novel and Effective Amusement Device for the Youngsters Made from Parts Everywhere Available; Insert, Detail of Roller-Skate Mounting

Make sure that the tree trunk is solid and saw one end off very smooth and level. At the lower end spike two cross pieces of wood with screw-spikes, so as to form a base and hold the post in a firm, upright position. It is very important that the post be firm. Dig a hole and set the base 12 to 18 in. below the surface of the ground, filling in around the post and packing the soil down thoroughly. Bore a 1-in. hole vertically in the center in the top of the post 6 in. deep. Have the pipe threaded for about 6 in. at one end, and screw the pipe tightly into the hole in the post with a pipe wrench. So much for the post. Bore a 1¼ or 1½-in. hole through the middle of the plank; if no expansion bit is available a series of little holes can be drilled in a circle and the wood cut out with a knife or a chisel. Now take the two front ends of the roller skates (extension skates are the best), hammer the clamps out flat and attach these to the plank on opposite sides of the hole. They should be screwed on, preferably by drilling suitable screwholes through the iron skate tops. The arrangement of the two roller-skate ends is clearly shown in the photograph. The distance between the two outer rollers must not exceed the diameter of the post or the circular bedplate upon which they are to run. If a large wagon-wheel hub can be obtained and sawed in two this will make an excellent bedplate or runway if placed on top of the post, upon which the rollers will run. This is what was done in the picture, but it is not essential if a good solid hardwood tree trunk is used. The half hub must be firmly screwed to the top of the post by screw bolts sunk below the top surface.

If this apparatus is carefully made it is astonishing what a lot of rough usage it will stand and how smoothly it will operate. Care should be taken, of course, in

attaching the roller skates, to be sure that the four wheels are in a single line which passes through the center of the pipe.

The plank with the rollers can easily be lifted from the post and taken indoors for protection.

Camp-Chair Kinks

The three chairs shown in the drawing were so popular in a summer camp, where comfort came before style, as to make the

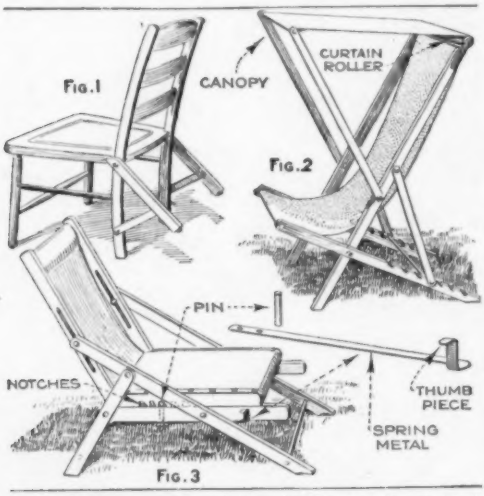


Fig. 1: Extra Legs Permit Leaning Back; Fig. 2: Chair with a Canopy; Fig. 3: Chair with a Sliding Seat

construction of several more necessary for the season.

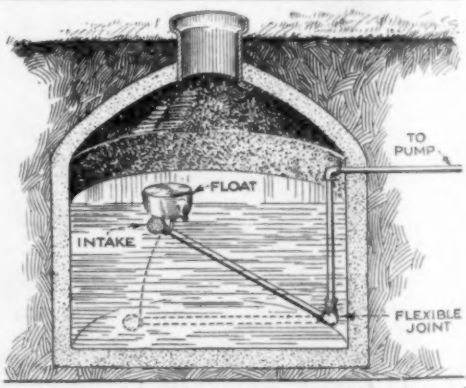
Fig. 1 shows one that was used by those persons who always like to tilt a chair backwards, but also want assurance that it will not go over with them. To attain this, two strong additional legs, attached to the regular rear legs, as shown, were all that was necessary.

Fig. 2 shows a chair provided with a canopy for shade seekers. If the vertical pieces of the back do not extend far enough, metal extension strips are added so that an ordinary curtain roller can be attached. On this is rolled any material that is suitable for a shade, such as canvas, one end being tacked to the roller and the other end hemmed so that it can be slipped on a rod, which is fastened to a wooden strip on each side, as shown. The shade thus made can be pulled out as far as desired and is very convenient as well as neat looking when rolled.

An easy chair with a seat that may be slid back and forth to suit the most comfort-seeking patron, is shown in Fig. 3. Two horizontal rails are nailed to the inside of the legs of an ordinary deck chair. Near the center, the rails are drilled through, vertically, and wood or metal pins fitted loosely in the holes. Wooden strips are attached to the seat on either side; these slide on the rails, and are notched to receive the tops of the pins. A spring-steel lever, formed as shown, is screwed to the underside of each rail, and normally keeps the pins engaged with notches in the seat strips. To move the seat back or forth, the levers are depressed, the pins drop, and the seat is moved. Releasing the levers forces the pins into new notches.

Clear Water from the Cistern

No matter how carefully the water pipes are screened there is always a certain amount of dirt and sediment that gets into the cistern. This soon settles at the bottom, leaving the upper part of the water comparatively clear, but the clear water is not obtained at the pump because the intake pipe usually extends to within a few inches of the bottom and consequently the dirtiest water is pumped up first. An excellent method of obtaining clear water from the surface is to install a movable pipe attached to a float, as shown in the drawing. At the lower end of the present suction pipe screw on two elbows to form a flexible joint. This can be done by using one street elbow and one ordinary one.



Movable Extension Pipe with Filter, Held by Means of a Float, Insures Clear Water at Pump

From this flexible joint extend a length of pipe slightly beyond the center of the cistern so that it will be long enough to reach the surface of the water, the joint being loose enough to allow the extension pipe to be raised or lowered easily.

It is not necessary that the flexible joint be airtight, since it is always below the surface of the water and leakage will not in-

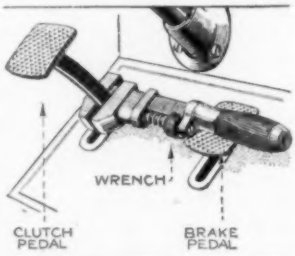
terfere in any way with the suction of the pump. The intake end of the extension pipe is fitted with a filter and is attached to a float. An old copper kettle with the lid soldered on and the spout closed so that it is airtight is well adapted for this purpose. The handle of the kettle is securely wired to the end of the extension pipe, as shown, so that the latter will remain within a few inches of the surface of the water, whatever the depth may be.—Harry D. Tiemann, Madison, Wis.

Cleaning Typewriters

Typewriters are usually cleaned by means of long, thin brushes, with which one can get at the dirty parts only with considerable difficulty, due to the intricacy of the mechanism. It has been found that the dust and dirt can be removed very effectively by means of a vacuum cleaner, when one is available. The hose and one of the blower nozzles are attached and it then takes only a few moments to clean the entire typewriter. With this method the work can also be done much better than with a brush, as the air is forced into the small spaces that cannot be reached with the brush, and there is no danger whatever of doing any damage to the typewriter.—M. B. Brooks, Chicago, Ill.

Wrench Holds Car Pedals

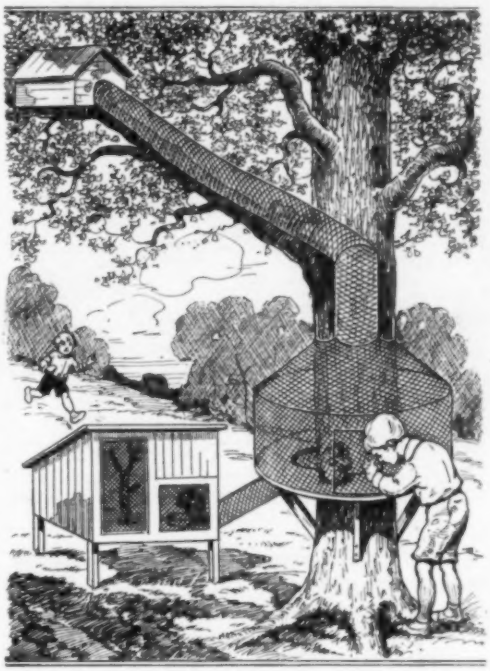
Various devices are used for holding the pedals of the car depressed while equalizing the brake bands or making clutch adjustments. An excellent method of holding the pedal down effectively is shown in the illustration. Any common monkey wrench attached to the shank of one pedal so that the handle extends over the other pedal, as indicated, can be used to do the work. The upward pressure on the handle causes the jaws to grip the shank of the other pedal firmly and prevent the pedal that is depressed from rising.—G. A. Luers, Washington, D. C.



¶A can of lye dissolved in a bucket of boiling water will clear drain pipes of grease and other organic matter.

An Improved Squirrel House

Most children enjoy having pets such as rabbits and squirrels. A house that will accommodate several squirrels, and will permit them to climb a tree without danger



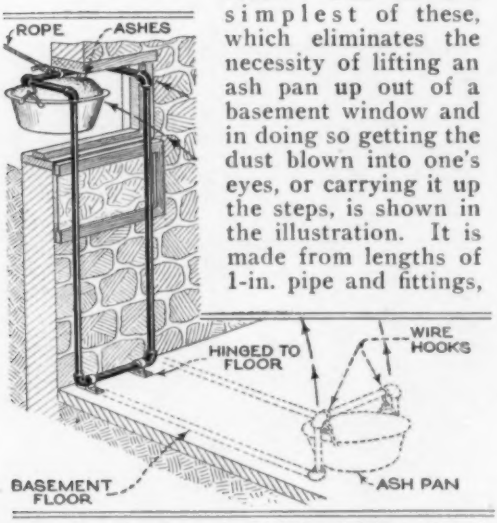
A Novel Squirrel House that Gives the Little Animals Plenty of Room

of escape, has been found to be a great improvement upon the small wooden houses generally used.

The main house should be about 2½ ft. square, with a roof slanting down from the front, and supported on posts 3 ft. high. The front side should face the south; it should be as open as possible, and covered with 1-in. poultry mesh. The house should be located close to a tree, so that a runway, 8 to 10 in. square, can be built from the house to a feeding platform, built around the tree as shown. The runway is built of 1-in. lumber and poultry mesh. The floor of the feeding platform is about 8 or 10 in. wide, made of pine boards and supported by wooden brackets nailed to the tree; a heavy wire frame, covered with 1-in. poultry mesh is used to inclose it. From the feeding platform another runway, also made of poultry mesh, leads up along the tree trunk and over one of the limbs to a small wooden house on the end of the limb.—George L. Furse, Webster Groves, Mo.

Removing the Furnace Ashes

Carrying ashes from the furnace cellar is a task that is usually disliked and many contrivances are designed to lighten this labor. One of the simplest of these, which eliminates the necessity of lifting an ash pan up out of a basement window and in doing so getting the dust blown into one's eyes, or carrying it up the steps, is shown in the illustration. It is made from lengths of 1-in. pipe and fittings,



Convenient Pipe Frame for Hoisting Ash Pans Out of Basement Windows

so that it will reach from the basement floor to the top of the window. One end is securely hinged to the floor and two wire hooks provided on the other end. A length of rope is attached, as indicated, so that the frame can be pulled up to the vertical position by a helper outside.

Repairing Violin Bow

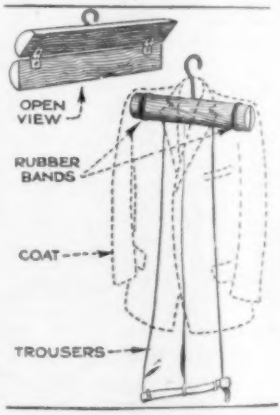
If violin bows are broken at the tip, as shown in the photograph, the job of repairing them is usually given up as impossible, but it has been found that if properly glued, wired, and braced, such bows can be made serviceable for a long time. Glue and wire alone will not hold the broken pieces together, as the tip is placed under considerable tension when the hairs are pulled tight by the thumbscrew at the frog. A small headless wire nail, sharpened to a point at each end, must therefore be set in two shallow notches or holes cut at the points indicated to act as a prop, in addition to the wire; the nail should just fit snugly when the hairs are loose. The bow shown in the photo was drilled in two places at the tip for double wiring, but one wire was found strong enough to hold it.—Leslie H. Phinney, Springfield, Mass.

Destroying Man-Scent Near Traps

Due to the keen sense of smell possessed by most fur-bearing animals, one of the greatest problems of the trapper is to destroy his own scent after having set his traps. There are numerous methods of accomplishing this, but perhaps none is so simple and effective as the following: Several newspapers are spread out over the ground, and the trapper steps on them until he reaches the spot where he is to set the trap. As he walks away on the papers he sets fire to them one by one. The papers burn up, the ashes are blown away by the wind, and all scent of the trapper is lost. There is practically no danger of fire when using this method, as the fur-trapping season is during the winter when the ground is covered with snow, or is wet with rain, but every precaution should be taken to see that no trace of fire remains before the trapper leaves the spot.

Keeping Trousers Pressed

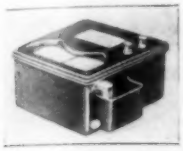
The manner in which trousers are usually folded causes deep wrinkles if they are permitted to remain in this condition for any length of time. By rolling the trousers on a cylindrical wooden clamp, this trouble will be entirely eliminated and the press will even be improved. The clamp consists of a length of round wood about 15 in. long and 3 in. in diameter. It is cut in half lengthwise, and fastened together with two small brass hinges screwed on securely. The cuffs of the trousers are placed between the pieces and rubber bands used to keep the pieces together tightly. The trousers can then be rolled around it. If desired, a clamp of this kind can also be used as a hanger for both trousers and coat, an ordinary screw hook being provided to hang it up, as shown in the drawing.—H. A. Sears, Winfield, Kan.



¶Cream for butter making should contain about 30 per cent butter fat.

ELECTRIC METER TESTS BOILER WATER

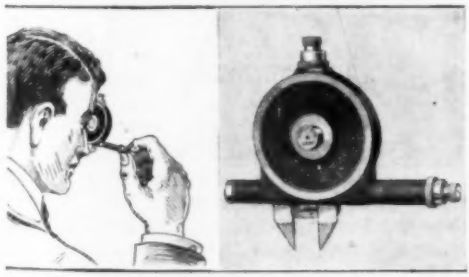
Water for boilers in many plants is treated chemically so that impurities may be removed, and in order to prevent the formation of scale. The concentration of chemical salts in a boiler constantly increases, and if the water is allowed to contain too great a percentage of the chemical, corrosion, foaming, or priming may result. The proper time to blow down the boiler, however, to decrease the chemical content, may be determined very simply by means of a meter now on the market. A cup on the side of the meter is filled with water drawn from the boiler, and the meter terminals connected to an alternating-current circuit. The concentration of the salts in the boiler may then be read directly from the scale of the meter.



OPTICAL MICROMETER CHECKS GEAR TEETH

For checking the thickness of gear teeth at the pitch line, solid gear-tooth gauges or adjustable vernier calipers are used. The former are not always accurate, and the vernier calipers are hard to set, owing to the fineness of the graduations.

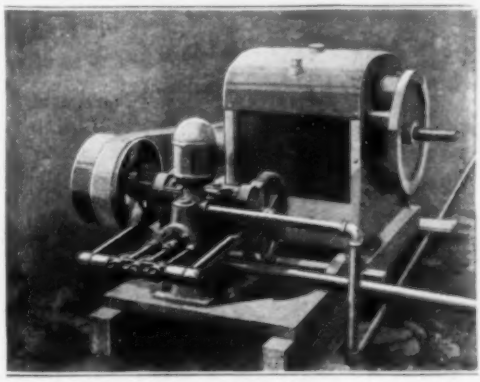
A new optical gear-tooth micrometer overcomes these troubles. The tool is held close to the eye, and, by looking through a small hole in the center, two well-defined, clear scales, engraved on glass, are seen. The scales are moved by turning the micrometer screws until the two measurements required are indicated, when the measuring jaws of the caliper are set, and ready for use. The range of the tool is from 18 to 1½ diametral pitch, and it is graduated to .001 inch. It may also be used for checking cutters and gauges.



Gear-Tooth Micrometer that Is Accurate and Easily Set to Size

ADJUSTMENTS EASILY MADE ON INVERTED ENGINE

A radical departure from the usual type of contractor's engine is one recently designed, in which the combustion chambers are at the bottom, and the crankshaft on top. This makes all moving parts readily accessible for repairs without any decrease in power and efficiency.



Fully Inclosed Engine with Crankshaft on Top, Driving Contractor's Pump

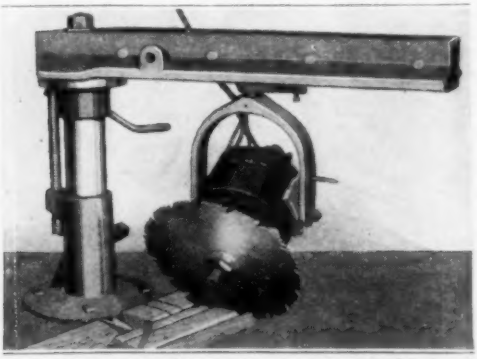
The unit is fully inclosed so that it need not be housed over when used to drive concrete mixers, etc., which are used out in the open, but the housing may quickly and easily be removed when necessary. The speed range is from 300 to 1,200 r.p.m., and the hp. from 5 to 10. By providing two power take-offs, practically any speed within the range may be obtained.

CHATTERLESS REAMER

Because every other blade of a new expansion reamer is at an angle to the axis of the hole, while the remaining blades are parallel, it is claimed that chatter is eliminated. The reamer is expanded from the center by a plug which is adjusted by a screw in the end. In the wrench end is a large hole through which the center cavity can be filled with oil, which flows outward through the slots to the cutting edges. A special feature is the cutting edges on the nose of the reamer, or pilot, which remove burrs and permit easy entrance.

BENCH WOODWORKER IS UNIVERSAL MACHINE

A machine that should appeal to woodworking shops everywhere has lately been



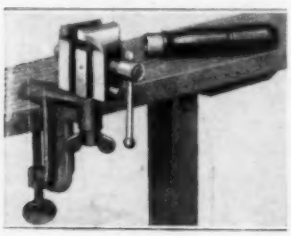
Woodworking Machine that Handles an Unusually Wide Range of Work

put on the market. It is a universal machine in every sense of the word, for, in addition to being a ripsaw and compound cross-cut, it can be used as a tenoner, shaper, machine-knife grinder, lathe and jigsaw, and can be used for mitering, beveling, dadoing, routing, sanding and fluting, on any rake or bevel.

The tool is self-contained, the drive to the tool being direct from the motor, which is hung in a swivel mounting from the overhead carrying arm, and may be locked in any position. A lathe attachment that will swing stock up to 8 in. in diameter is furnished, as well as a jigsaw attachment for saws from 6 to 12 in. long, with a tilting table. A flexible shaft, 83 in. long, fitted with a chuck for drills up to ⅜ in., enables drilling to be done in any position.

CLAMP MAKES BENCH VISE OF HAND TOOL

Furnished with a clamp by means of which it may be used on the bench, a hand vise is now made that will appeal to all mechanics as well as those working around the home. By removing the handle, the clamp may be attached, and the vise may then be fastened to benches, shelves, or tables having a thickness of ½ to 2⅛ in. The vise can be swiveled to different positions to meet the convenience of the user. An added refinement is the use of a ball-end handle, as in a large vise, instead of the wingnut usually provided to tighten small hand vises. The jaws are 1½ in. wide and have a capacity for work about 1½ in. thick.



FIBER SLEEVES PROTECT METAL PARTS

Protectors for metal parts, adapted for use in machine shops and other metal-working plants, are now on the market.

Many parts in process of manufacture possess sharp edges, threads, shoulders, or corners, which are easily damaged when the parts are handled in bulk. The protectors are furnished in a variety of shapes and sizes, and are slipped over the parts after machining, remaining with them until they are assembled or shipped.

TESTS SPARK PLUGS UNDER RUNNING CONDITIONS

The spark voltage required to jump a gap depends upon the atmospheric pressure; the higher the compression, the higher the voltage required. The usual method of testing spark plugs—under atmospheric pressure—is therefore faulty, as a plug may appear good at this pressure, yet fail to operate under high compression. A twin spark-plug test set is now on the market that tests the plug under running conditions in regard to pressure, and compares it with a plug known to be perfect. One chamber of the tester is fitted with the plug to be tested, the other contains the good plug. The chambers are then placed under compression through an air valve, and the plugs connected to the current supply, either separately or in tandem. Various tests are possible with this set, which should prove of value to any garage or service station.

¶A round broach is particularly effective when finishing holes in cast iron, as it has a tendency to harden the hole surface.

WATER-RESISTING GLUE EVOLVED BY BUREAU

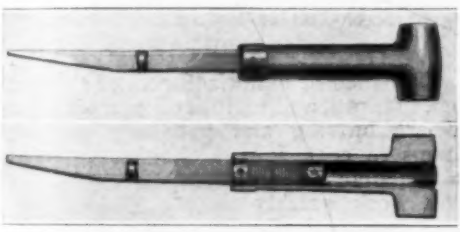
The U. S. Forest Products Laboratory at Madison, Wis., has perfected a casein-silicate glue used to a considerable extent during the war. The improvement lies in the addition of certain copper salts to the old formula, which gives the glue more strength and resistance to water.

A number of woodworking factories used this formula until stopped by threats of suit for infringement by a private party. Upon consideration of the case, the patent was granted to the laboratory, to be dedicated to the people for their free use.

ONE HAND OPERATES HAMMER-DRIFT

Damage to taper-shank tools such as drills, reamers, etc., when being removed from machine spindles, is eliminated by the use of a new combination.

The device has a cast-brass body, one end being formed into a hammer head for inserting the tools firmly into machine

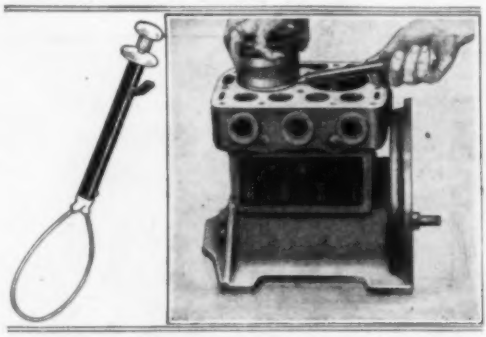


Combined Hammer-Drift that May Be Operated with One Hand

spindles without damage. In the bore of the body is contained a sliding drift, tapered for ejecting the tools at one end, and heat-treated at the other to provide a hardened face, which makes contact with a hardened impact screw in the head. The drift is fitted with a tension spring to return it to its original position after each blow. As the tool to be removed may be held by the left hand while the drift is operated with the right, there is no danger of dropping it on the machine table and damaging its point or flutes.

PISTON-RING COMPRESSOR FREES BOTH HANDS

Compressing the ring into truly circular form, and automatically locking it when compressed, a piston-ring compressor, now available, is particularly neat and efficient. The compression is effected by means of a steel cable, operated by a pull rod sliding in the steel handle. The tool is made in two sizes; the first will handle all rings from 2¾ to 4 in. in diameter, inclusive, and the second, rings up to 8 in. in diameter.

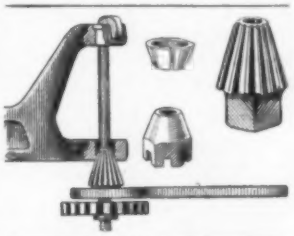


Left, Detail of Piston-Ring Compressor; Right, Compressor in Use

The automatic lock on the pull rod grips it in such a way that there is no slack or slip after the ring is compressed, and both hands are left free to handle the piston. The tool can be used to compress rings for measurement, as plenty of room for calipers or micrometer is left on each side of the cable. In cramped quarters, as when a piston must be drawn in from the underside of the cylinder, it is especially valuable.

CENTER REAMER RECLAIMS AUTO AXLES

A tool that eliminates the continual fitting of new bushings in the spindle-bolt holes of automobile front axles is now available. It consists of a reamer that cuts a cone-shaped hole. By placing a cone-shaped washer on the top end of the spindle, and a cone-shaped locknut on the lower end, the spindle bolt is held centrally, stopping all "wobble" in the front wheels, preventing heavy wear on tires, and making driving easier. The reamer is operated with a ratchet lever and feed wheel, and reams both upper and lower arms of the axle fork to fit the washer and nut. The locknut can be tightened whenever necessary, thus, it is claimed, avoiding the necessity of fitting a new axle to stop "shimmying."



AUTO COILS ARE TESTED BY MACHINE

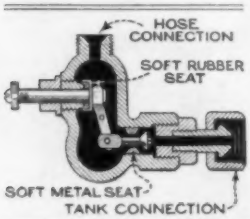
By simply turning the crank and watching the ammeter, it is possible to test and adjust Ford coils with a new machine without removing them from the car, if desired. The machine uses coils and magnets of the same type as used on the car, and the ammeter shows the current drawn by the coils.

Testing and Adjusting Auto Coils by Means of a Crank-Operated Machine

The magneto may also be tested in the car by connecting leads to the terminals of the machine, and test clips to the magneto terminal and to the frame of the car. A special support is used in connection with the machine for testing spark plugs.

VALVE SAFEGUARDS OXY-ACETYLENE LINES

Bursting of hose lines, waste of gas, damage to regulators and torches from backfiring, spreading of fires and injuries to employes are the outstanding difficulties experienced by users of oxyacetylene cutting and welding apparatus. The risk of these dangers is considerably minimized by the use of a very practical automatic safety valve now on the market. The valves come in pairs, and are simply attached to the regulators, a button on the side pulled out and held for a moment to allow the pressure to build up in the hose, then the work is commenced. The valve instantly and automatically closes when the hose line or fittings fail from any cause, preventing waste of gas.



TOOLS MADE OF HARDENED MALLEABLE IRON

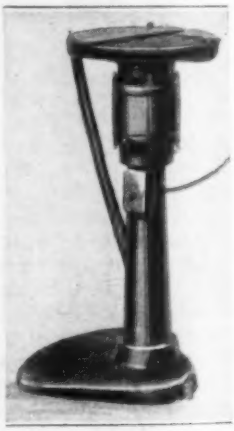
In an effort to discover if malleable iron could be used to produce medium-grade tools, intermediate between cheap tools that break easily, and high-grade cast-steel ones selling at a comparatively high price, a manufacturer heated a number of malleable bars to various temperatures, and quenched them. The result was rather surprising, as the quenched metal was extremely hard, and, in many cases, showed a fine-grained fracture resembling steel.

As a practical test, a bar was roughly ground to the shape of a twist drill, hardened, and used to drill brass, gray iron, malleable iron, steel, and even hardened white iron. A number of hammers made of the hardened metal were also tested in various shops, and stood up excellently, without "mushrooming" or chipping.

The possibilities of the new process have not yet been fully investigated, but it seems probable that there is a good field for tools of this character.

DISK GRINDER IS COMPACT AND PORTABLE

Demands of manufacturers of typewriters, firearms, and various other mechanisms where burring and polishing are large items in cost, for a machine to do the work quickly and economically have been met by the production of a portable, horizontal disk grinder. The machine is driven direct by a fully inclosed ball-bearing motor, and the disk is driven at a speed of 1,725 r.p.m.; a special feature is the exhaust system, by which the dust is carried through a flexible tube from the disk to the hollow column of the machine. The height from the floor is 40 inches, and the disk diameter 15 inches.



¶ Milling cutters, properly ground, running true, and with every tooth cutting, do better work, and can be crowded harder than a dull mill.

Prize Offers and Announcements

THOUSANDS OF DOLLARS IN SAFETY PRIZES TO TEACHERS AND PUPILS

Five hundred prizes, $6,500 in all, are offered by the National Automobile chamber of commerce to school children and teachers for the best essays on how to promote safety on the public highways of the nation. Details of the contest may be obtained from the Highway Education Board, Willard Building, Washington, D. C.

PRIZE ENGINES FOR AEROPLANES WILL WIN NINETY THOUSAND DOLLARS

Cash prizes totaling nearly $90,000 are offered by the French government for encouragement of design and construction of an airplane engine of 350 to 450 horsepower, capable of running long periods with a minimum amount of attention. Tests on the bench and in the air will be conducted as a basis for the awards. They will include a 240-hour brake test in periods of eight hours each, during which all involuntary stops will be penalized. The amount of fuel consumed will also be used as an important consideration in the decision of the judges.

ONE HUNDRED DOLLARS PAID FOR PLAY TO STIMULATE NATIONAL DRAMA

To foster interest in a national drama, the Theater Guild, of Boston, is offering a prize of $100 for the best play submitted before June 1, 1924. Manuscripts should be typewritten, signed with a pseudonym and accompanied by a sealed envelope bearing the title of the play and the pseudonym and inclosing the author's real name and address. Return postage should accompany all manuscripts. Plays should be sent to the Theater Guild of Boston, Play Competition, Fenway Postoffice, Box 142, Boston, Mass., Miss Angela Morris, Play Reader.

FIVE THOUSAND DOLLARS IN MANY PRIZES FOR LETTERS ON INVESTMENTS

One hundred and fifty prizes, totaling $5,000, are offered by Farm and Home for the best reports showing the greatest improvements realized on money invested in property between January 1, 1924, and December 1, 1924. The first prize is $1,000. A booklet giving the details of the contest will be sent upon application to the Home Improvement Editor, Farm and Home, Springfield, Mass.

STORY PLOTS TO WIN TEN THOUSAND DOLLARS IF ACCEPTABLE TO MAGAZINE

For each acceptable plot for a story in Novelets, $50 will be paid. The magazine is spending $10,000 for the 1924 budget for plots for its 24 numbers. For further particulars, address Mr. J. B. Kelly, Editor, Novelets, Printing Crafts Building, 461 Eighth Avenue, New York City.

ONE THOUSAND DOLLARS FOR TRIP TO EUROPE FOR BEST JEWELRY DESIGN

For the best jewelry design submitted by an art student in the United States, the Cartier Prize of $1,000 for a year's study in France is given through the Art Center, 65 East Fifty-sixth Street, New York City. Additional prizes of $100 and $50 also are offered. Designs must be mailed before April 19 or delivered to the committee on arrangements of the Cartier Prize at the above address before April 25.

TWO-THOUSAND-DOLLAR GOVERNMENT JOB OPEN IN COAST SURVEY SERVICE

Civil service examinations for junior engineer and deck officer to fill vacancies in the coast and geodetic survey service of the United States at an entrance salary of $2,000 a year are to be conducted soon. Receipt of applications will close June 30. Applicants must have completed at least three and one-half years of a course in civil engineering leading to the degree of C. E. or B. S. in civil engineering in a college or technical school of recognized standing, but graduation with one of these degrees will be required before appointment.

TWO THOUSAND DOLLARS FOR SNAPPY BITS TO NEWSPAPER FUNNY COLUMN

Every month, The Main Street Kolyumnist, Waupun, Wis., gives prizes for the funniest story, most ludicrous news clipping or other bit suitable for publication in the paper. Homely bits of philosophy and humorous anecdotes are wanted. In all, $2,000 will be distributed in this way.

BOY SCOUTS GET FIVE DOLLARS EACH MONTH FOR BEST PICTURE AND LETTER

Boy's Life, 220 Fifth Avenue, New York City, offers a monthly prize of $5 for the best picture relating to boy-scout activities and for the best letter telling why the writer subscribed to the magazine.

TWO HUNDRED AND FIFTY DOLLARS GIVEN IN MONTHLY MAGAZINE PRIZES

Prizes to the amount of $250 are offered each month by the California Authors Club, 322 Laughlin Building, for the best articles, stories and poems suitable for publication in the California Guide.

FIFTY DOLLARS OFFERED TO WRITER OF POEM CELEBRATING THE DAHLIA

Fifty dollars will be paid by the Garden Magazine, Garden City, New York, for the best poem about the dahlia. Verses should be in joyous mood, must not exceed six stanzas and should be submitted before October 1, 1924.

CONTESTS PREVIOUSLY ANNOUNCED

Newspaper Offers Prizes: Announced March issue; The Chicago Tribune pays $1 each for "Bright Sayings of the Children" and accounts of "My Most Embarrassing Moment" accepted for publication. Love letter, joke, jingle and other contests are conducted by this paper from time to time, details of which may be had by writing to the contest editor.

Prize for Story about Jails: Announced April issue; The Cosmopolis Press, 257 West Seventy-first Street, New York City, will pay $1,000 for the best story adaptable to a motion-picture scenario or play on the subject of the American jail as a contributing force to crime.

Peace Plan to Win $25,000: Announced April issue; a prize of $12,500 on acceptance of the best plan for international peace and an additional $12,500 when the plan is put into effect will be paid by the World Federation of Education Associations, Augusta, Maine.

Economic Essay Contest: Announced April issue; Hart, Schaffner and Marx offer prizes totaling $2,000 for the best essays dealing with economic subjects.

Advertising Prizes: Announced March issue; Edward W. Bok, donor of the peace prize, offers a gold medal and $8,500 in awards to promote superior advertising in the United States during the year October, 1923, October, 1924.

Thrilling Experiences to Win Money: Announced March issue; Three prizes, $25, $15, and $10 are offered by Ace High Magazine for accounts of "My Most Thrilling Experience." Address manuscripts to Readers' Publishing Corporation, 799 Broadway, New York City.

Textile Men Offered Prizes: Announced March issue; for the best suggestion relative to improvements in the textile industry, The American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass., offers prizes to the amount of $2,000.

FROM THE EDITOR'S MAIL BAG

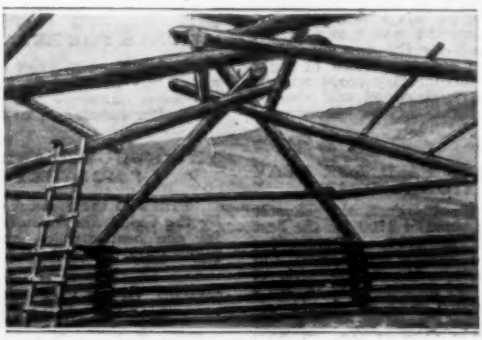
The following is a list of some of the things I have made from instructions contained in your magazine: Pulleys from pan lids; mission frame from alarm clock; pliers as bench vise; rabbet plane; dowel-cutting tool; safety catch on window; weatherstrip from inner tubes; fruit-jar opener; handy reel for extension cord, and pliers for driving tacks, as well as numerous other articles that I cannot remember at present.—G. P. V. Dodwell, Halifax, N. S.

* * *

As I have been a shop carpenter for a number of years, I fully appreciate the value of the Shop Notes in Popular Mechanics, and have made use of many suggestions found therein.—J. M. Sheppard, Boston, Mass.

* * *

Your request brings to my mind an article taken from Popular Mechanics more than twenty years ago. I was then ranching on the "Big Grovont," forty miles east of Jackson Hole, Wyo., far from any sawmill. All buildings were made of logs, thatched over with long poles and hay. In designing my round shed for cattle I wished to do away with center supports, and thus make the cleaning out by team and scraper much easier. A cut that showed how to span a ravine with stringers having no supports in the middle gave me the idea for my log shed—eight sides, 18 ft. to a side. The accompanying photo will give you an idea of how I made use of the principle described.—Milton Robinson, Wenona, Illinois.



How Mr. Robinson Adapted a Popular Mechanics Article to Suit His Cattle Shed

* * *

Most of my interest is centered in the Radio dept. The first I made—I think about two years ago—was that variometer-variocoupler hookup, which gave splendid results. Then the Reinartz, and there was a set! With detector and 2 steps I have to date logged ninety-three stations, including Havana, California—in fact some out of every district in the U. S. A. Some set is right! And the volume of stations within 1,000 miles works the lil' ol' loud speaker some. Am now working on the Neutrodyne.—Stanley J. Currie, Huntingdon, Que., Can.

* * *

Have made many things from your magazine. For the "tinker" and home worker I consider it invaluable. I expect to read every issue as long as I live. I sharpen lathe points perfectly with small tool I made; also made a blowtorch from an old gas stove that works as well as any on the market, and has for years. The casters on my garage creeper were put on according to description in Popular Mechanics. These are just a few of the articles I have been able to make through the help of the magazine.—J. E. Dekker, 2607 Windsor Ave., Chicago, Ill.

* * *

I have made an upright tool cabinet from Shop Notes in your July issue of 1923.—Allen A. Wiest, 143 E. Dewart St., Shamokin, Pa.

* * *

On page 304, February, appears an impossible formula. The title is "Brazing and Soldering Flux." The proportion of acid to zinc is about right if the acid is full strength, but it is better to "saturate" the acid with the zinc, that is, add zinc a little at a time to the acid until it will dissolve no more. The sal ammoniac is better omitted. The resin (English or any other nationality) will not dissolve in the acid (either before the zinc is dissolved or after) nor in water. It is absolutely the joker in the formula.

A formula containing resin must have no water in it. Such a formula is sometimes wanted where the solder or brazing must be confined to a certain place. Such a formula is:

Zinc chloride granular	1 part
Resin (rosin)	2 parts
Wood or denatured alcohol	10 parts

When this is applied, the alcohol evaporates and leaves an almost dry "varnish" and the molten metal will only go where it is.

I dislike to see a magazine like yours publish an impossible formula. It makes trouble for the user and is bound to make him have less confidence in you.—E. P. Ferte, Los Angeles, Calif.

The author's reply follows:

I have had marked success in using this flux in brazing bandsaws which later were subjected to a strain of 1½ tons. Nor has it ever given me any trouble. However, I am a mechanic, not a chemist. The sal ammoniac might be omitted without weakening the solution. I do not know. I use the formula only as it was given me by an expert saw filer who used it himself. Possibly the resin will not dissolve in the acid (I use powdered resin, and there always is a heavy sediment in the bottom of the bottle). But neither the sal ammoniac nor the resin do the flux any harm or it could not be used in brazing bandsaws which are held on the band wheels by tons of strain. I have seen expert filers use it in brazing saws which later were subjected to a strain of 4½ tons. So your reader has made statements which are absolutely incorrect. The formula might fail in theory, but I know that it will succeed in actual practice. I have used it with marked success both in soldering sheet metals and in brazing saw steel, and have given it a six-year trial.

I wonder if your reader went to the trouble of analyzing the finished solution or of having this done, or of giving it a fair trial in soldering or brazing? He surely did or he would not so confidently assert that the resin is a joker in the formula, and that the formula itself is impossible.—Clarence Uplinger, Cincinnati, Ohio.

* * *

Our attention has been attracted to an item in "The ————" regarding balloon tires because of the several inaccuracies in the statements regarding an article reproduced from Popular Mechanics for December.

"The ————" is wholly wrong in stating that the balloon tire "cannot fit the ordinary auto wheel" and that "to equip a car with balloon tires necessitates buying new wheels as well."

Our tires are being fitted very successfully to leading makes of cars without any change of wheel and rim equipment and are attracting widespread attention.

There are also two or three other makes that have been put on the market since the Michelin balloon was introduced here that are designed for standard wheels.—Michelin Tire Company, Milltown, N. J.

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I have made two bookcases, two side chairs, and a Morris chair, and if I need any information on any job that I don't quite understand, I look it up in your Shop Notes.—Maurice S. Jones, Syracuse, N. Y.

IN accordance with the editorial policy of this magazine never to accept compensation in any form for what appears in our reading pages, and also to avoid all appearance of doing so, we are obliged to omit the name of the maker or seller of any article described. This information, however, is kept on file and will be furnished free, by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. [Editor.]